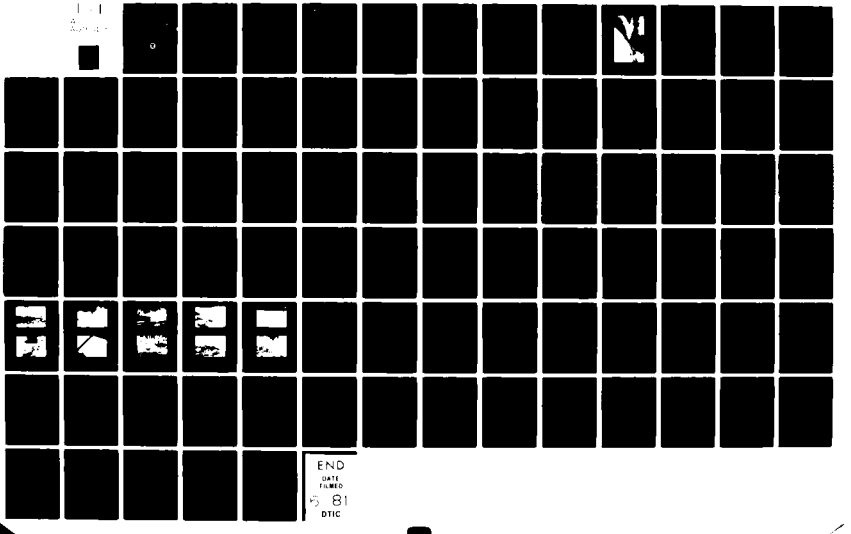
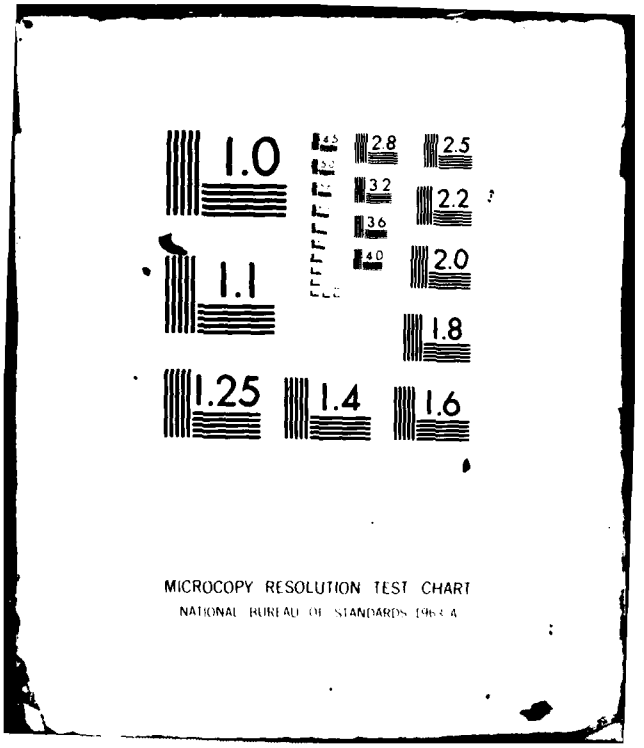
AD-A099 425 NEW JERSEY DEPT OF ENVIRONMENTAL PROTECTION TRENTON --ETC F/G 13/13
NATIONAL DAM SAFETY PROGRAM. FORGE POND DAM (NJ00807), WHIPPANY--ETC(U)
MAY 81 J GRIBBIN, R MCDERMOTT DACW61-79-C-0011

UNCLASSIFIED DAEN/NAP-53842/NJ00807-81/ NL



END
DATE FILMED
5 81
DTIC


1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963-A

AD A099425

WHIPPANY RIVER BASIN,
TROY BROOK, MORRIS COUNTY,
NEW JERSEY.

(6) National Dam Safety Program.

LEVEL II

(1)

FORGE POND DAM
(NJ 00807).

DTIC
ELECTE
MAY 23 19
S D
E

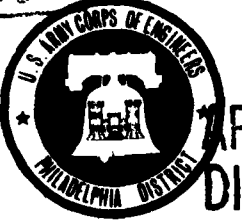
PHASE 1 INSPECTION REPORT.
NATIONAL DAM SAFETY PROGRAM

(10) John /Gribbin
Richard /McDermott

(15) DACW61-79-C-0011

(12) 189

(9) Final Rept.,



DEPARTMENT OF THE ARMY
Philadelphia District
Corps of Engineers
Philadelphia, Pennsylvania

Rept. No. (13) DAEN/NAP-53842/NJ00807-81/05

(11) MAY 81

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER: DAEN/NAP-53842/NJ00807-81/05	2. GOVT ACCESSION NO.: AD-A099 425
3. RECIPIENT'S CATALOG NUMBER:	
4. TITLE (and Subtitle): Phase I Inspection Report National Dam Safety Program Forge Pond Dam, NJ00807 Morris County, NJ	5. TYPE OF REPORT & PERIOD COVERED: FINAL
	6. PERFORMING ORG. REPORT NUMBER:
7. AUTHOR(s): Gribbin, John P.E., McDermott, Richard P.E.	8. CONTRACT OR GRANT NUMBER(s): DACW61-79-C-0011
9. PERFORMING ORGANIZATION NAME AND ADDRESS: Storch Engineering 220 Ridgedale Ave. Florham Park, NJ 07932	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS:
11. CONTROLLING OFFICE NAME AND ADDRESS: NJ Department of Environmental Protection Division of Water Resources P.O. Box CN029 Trenton, NJ 08625	12. REPORT DATE: May, 1981
	13. NUMBER OF PAGES: 65
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office): U.S. Army Engineer District, Philadelphia Custom House, 2d & Chestnut Streets Philadelphia, PA 19106	15. SECURITY CLASS. (of this report): Unclassified
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE:

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Copies are obtainable from National Technical Information Service, Springfield, Virginia 22151.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dams
Embankments
Visual Inspection
Structural Analysis
National Dam Safety Program
Whippany River Basin
Troy Brook, NJ
Forge Pond Dam, NJ

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report cites results of a technical investigation as to the dam's adequacy. The inspection and evaluation of the dam is as prescribed by the National Dam Inspection Act, Public Law 92-367. The technical investigation includes visual inspection, review of available design and construction records, and preliminary structural and hydraulic and hydrologic calculations, as applicable. An assessment of the dam's general condition is included in the report.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CUSTOM HOUSE—2 D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

IN REPLY REFER TO
NAPEN-N

20 MAY 1981

Honorable Brendan T. Byrne
Governor of New Jersey
Trenton, New Jersey 08621

Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for Forge Pond Dam in Morris County, New Jersey which has been prepared under authorization of the Dam Inspection Act, Public Law 92-367. A brief assessment of the dam's condition is given in the front of the report.

Based on visual inspection, available records, calculations and past operational performance, Forge Pond Dam, initially listed as a high hazard potential structure, but reduced to a significant hazard potential structure as a result of this inspection, is judged to be in fair overall condition. The dam's spillways are considered inadequate because a flow equivalent to 19 percent of the One Hundred Year Flood would cause the dam to be overtopped. To ensure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The spillways' adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures and studies within six months from the date of approval of this report. Within three months of the consultant's findings remedial measures to ensure spillway adequacy should be initiated.

b. Within six months from the date of approval of this report the following remedial actions should be initiated:

(1) The upstream face of the dam should be properly protected against erosion.

(2) The downstream side of the spillway structure should be properly protected and supported in the area of displaced boulders.

(3) The stone masonry walls of the outlet works should be properly supported or reconstructed.

(4) All trees and adverse vegetation on the embankment should be removed.

(5) Seepage at the dam should be periodically monitored in order to detect any changes in its severity or its effects on the structural stability of the dam.

c. The owner should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam within one year from the date of approval of this report.

d. An emergency action plan should be developed which outlines actions to be taken by the owner to minimize the downstream effects of an emergency at the dam within six months from the date of approval of this report.

A copy of the report is being furnished to Mr. Dirk C. Hofman, New Jersey Department of Environmental Protection, the designated State Office contact for this program. Within five days of the date of this letter, a copy will also be sent to Congresswoman Fenwick of the Fifth District. Under the provision of the Freedom of Information Act, the inspection report will be subject to release by this office, upon request, five days after the date of this letter.

Additional copies of this report may be obtained from the National Technical Information Services (NTIS), Springfield, Virginia 22161 at a reasonable cost. Please allow four to six weeks from the date of this letter for NTIS to have copies of the report available.

An important aspect of the Dam Inspection Program will be the implementation of the recommendations made as a result of the inspection. We accordingly request that we be advised of proposed actions taken by the State to implement our recommendations.

Sincerely,

JAMES G. TON
Colonel, Corps of Engineers
District Engineer

1 Incl
As stated

Copies furnished:
Mr. Dirk C. Hofman, P.E., Deputy Director
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

Mr. John O'Dowd, Acting Chief
Bureau of Flood Plain Regulation
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

FORGE POND DAM (NJ00807)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 17 December 1980 and 23 February 1981 by Storch Engineers, under contract to the State of New Jersey. The State, under agreement with the U.S. Army Engineer District, Philadelphia, had this inspection performed in accordance with the National Dam Inspection Act, Public Law 92-367.

Forge Pond Dam, initially listed as a high hazard potential structure, but reduced to a significant hazard potential structure as a result of this inspection, is judged to be in fair overall condition. The dam's spillways are considered inadequate because a flow equivalent to 19 percent of the One Hundred Year Flood would cause the dam to be overtopped. To ensure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The spillways' adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures and studies within six months from the date of approval of this report. Within three months of the consultant's findings remedial measures to ensure spillway adequacy should be initiated.

b. Within six months from the date of approval of this report the following remedial actions should be initiated:

(1) The upstream face of the dam should be properly protected against erosion.

(2) The downstream side of the spillway structure should be properly protected and supported in the area of displaced boulders.

(3) The stone masonry walls of the outlet works should be properly supported or reconstructed.

(4) All trees and adverse vegetation on the embankment should be removed.

(5) Seepage at the dam should be periodically monitored in order to detect any changes in its severity or its effects on the structural stability of the dam.

c. The owner should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam within one year from the date of approval of this report.

d. An emergency action plan should be developed which outlines actions to be taken by the owner to minimize the downstream effects of an emergency at the dam within six months from the date of approval of this report.

APPROVED: James G. Ton

JAMES G. TON
Colonel, Corps of Engineers
District Engineer

DATE: 20 May 1981

PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam:	Forge Pond Dam, NJ00807
State Located:	New Jersey
County Located:	Morris
Drainage Basin:	Whippany River
Stream:	Troy Brook
Dates of Inspection:	December 17, 1980
	February 23, 1981

Assessment of General Condition of Dam

Based on visual inspection, past operational performance and Phase I engineering analyses, the dam is assessed as being in fair overall condition.

Based on investigations of the downstream flood plain made in connection with this report, it is recommended that the hazard potential classification be downgraded from high to significant hazard.

Hydraulic and hydrologic analyses indicate that the spillways are inadequate. Discharge capacity of the spillways is not sufficient to pass the designated spillway design flood (100-year storm) without an overtopping of the dam. The spillways are capable of passing approximately 18 percent of the spillway design flood. Therefore, the owner should engage a professional engineer experienced in the design and construction of dams in the near future to perform more accurate hydraulic and hydrologic analyses. Based on the findings of the analyses, the need for and type of remedial measures should be determined and then implemented.

The owner should, in the near future, develop an emergency action plan together with an effective warning system outlining actions to be taken by the operator to minimize downstream effects of an emergency at the dam.

Seepage at the dam should be periodically monitored in order to detect any changes in its severity or its effects on the structural stability of the dam.

It is further recommened that the following remedial measures be undertaken by the owner in the near future.

1) The upstream face of the dam should be properly protected against erosion.

2) The downstream side of the spillway structure should be properly protected and supported in the area of displaced boulders.

3) The stone masonry walls of the outlet works should be properly supported or reconstructed.

4) All trees and adverse vegetation on the embankment should be removed.

In the near future, the owner of the dam should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam.

Richard J. McDermott, P.E.

John E. Gribbin, P.E.

OVERVIEW - FORGE POND DAM

20 JANUARY 1981

TABLE OF CONTENTS

TABLE OF CONTENTS (cont.)

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. It is important to note that the condition of dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that the unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydraulic and hydrologic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydraulic and hydrologic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

FORGE POND DAM, I.D. NJ00807

SECTION 1: PROJECT INFORMATION

1.1 General

a. Authority

Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The Division of Water Resources of the New Jersey Department of Environmental Protection (NJDEP) in cooperation with the Philadelphia District of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the State of New Jersey. Storch Engineers has been retained by the NJDEP to inspect and report on a selected group of these dams. The NJDEP is under agreement with the Philadelphia District of the Corps of Engineers.

b. Purpose of Inspection

The visual inspections of Forge Pond Dam were made on December 17, 1980 and February 23, 1981. The purpose of the inspections was to make a general assessment of the structural integrity and operational adequacy of the dam structure and its appurtenances.

1.2 Description of Project

a. Description of Dam and Appurtenances

Forge Pond Dam is an earth dam with a concrete weir spillway and an outlet works controlled by stoplogs. The spillway consists of a concrete broad crested weir with a pile of very large boulders on its immediate downstream side.

The outlet works consists of a discharge channel formed by stone masonry walls which transversely penetrate the dam. Flow through the discharge channel is controlled by timber stoplogs. The stoplogs also form an auxiliary spillway in addition to the principal spillway.

The downstream face of the dam is formed by a stone rubble wall consisting of large boulders placed at a slope of 1 horizontal to 1 vertical.

The elevation of the spillway crest is 232.0 National Geodetic Vertical Datum (NGVD) while that of the outlet works (auxiliary spillway) is 231.1. The crest of the dam is at elevation 234.4 and the downstream channel bed elevation is 224.4. The overall length of the dam is 330 feet and its height is 10.0 feet.

b. Location

Forge Pond Dam is located in the Township of Parsippany-Troy Hills and impounds Forge Pond. Principal access to the dam is by a private road off the south side of Troy Road about one mile south of N.J. Route 46. Discharge from the spillway of the dam flows into Troy Brook.

c. Size and Hazard Classification

The dam is classified in accordance with criteria presented in "Recommended Guidelines for Safety Inspection of Dams" published by the U.S. Army Corps of Engineers. Size categories consist of Small, Intermediate and Large while hazard categories are designated as Low, Significant and High.

Size Classification: Forge Pond Dam is classified as "Small" size since its maximum storage volume is 77 acre-feet (which is less than 1000 acre-feet) and its height is 10 feet (which is less than 40 feet).

Hazard Classification: Visual inspection of the downstream flood plain of the dam together with breach analysis indicate that failure of the dam could result in damage to a public road bridge (Troy Road) located 1800 feet from the dam and a public road bridge located 2500 feet from the dam. It is not anticipated that dam failure during a storm equivalent to the SDF would cause inundation of the dwelling located approximately 1800 feet from the dam. Accordingly, Forge Pond Dam is classified as "Significant" hazard.

d. Ownership

Forge Pond Dam is privately owned by the Estate of John Crowell. All correspondence should be addressed c/o J.A. Hallock, 550 Broad Street, Newark, New Jersey 07201.

e. Purpose of Dam

The purpose of the dam is the impoundment of a lake used for recreation.

f. Design and Construction History

Forge Pond Dam reportedly was constructed prior to the Revolutionary War for the purpose of operating an iron forge. The forge ceased operating around 1800 and the lake has since been used for recreation. Reportedly, the crest of the dam was raised approximately 2 feet around 1910.

g. Normal Operational Procedures

The dam and its appurtenances have not been maintained or operated in recent years. No operation or maintenance records could be obtained.

Reportedly, the outlet works is not utilized (stoplogs removed) during periods of heavy rain to augment the spillway capacity. It is not known when the lake was last drawn down.

1.3 *Pertinent Data*

a. Drainage Area — 6.56 square miles

b. Discharge at Damsite

Maximum flood at damsite	Unknown
Outlet works at pool elevation	N.A.
Spillway capacity at top of dam	653 cfs

c. Elevation (N.G.V.D.)

Top of dam	234.4
Maximum pool-design surcharge	236.5
Spillway crest	232.0
Auxiliary spillway crest	231.2
Stream bed at toe of dam	222.5
Maximum tailwater	228.5

d. Reservoir

Length of maximum pool	1300 feet (Estimated)
Length of recreation pool	1100 feet (Scaled)

e. Storage (Acre-feet)

Recreation pool	29 acre-feet
Design surcharge	120 acre-feet
Top of dam	77 acre-feet

f. Reservoir Surface (acres)

Top of dam	19 acres (Estimated)
Maximum pool - design surcharge	20 acres (Estimated)
Recreation pool	9.18 acres

g. Dam

Type	Earthfill
Length	330.0 feet
Height	10.0 feet
Sideslopes - Upstream	1 horiz. to 1 vert.
- Downstream	1 horiz. to 1 vert.
Zoning	Unknown
Impervious core	Unknown
Cutoff	Unknown
Grout curtain	Unknown

h. Diversion and Regulating Tunnel — N.A.

i. Spillway

Type	Uncontrolled Weir
Length of weir	47. feet
Crest elevation	232.0

Gates	N.A.
Approach channel	N.A.
Discharge channel	Spillway discharges directly into downstream channel

j. Auxiliary Spillway (Outlet Works)

Type	Controlled Weir (Stoplogs)
Length of weir	4.3 feet
Crest elevation	231.2
Gates	Timber Stoplogs
Approach channel	N.A.
Discharge channel	Rectangular channel formed by stone masonry walls.

k. Regulating Outlet

Timber stoplogs 4.3 feet long.

SECTION 2: ENGINEERING DATA

2.1 Design

No plans or calculations pertaining to the original design of the dam could be obtained.

2.2 Construction

No data or reports pertaining to the construction of the dam are available.

2.3 Operation

No data or reports pertaining to the operations of the dam are available.

2.4 Evaluation

a. Availability

There is no available engineering data pertaining to the original construction of the dam.

b. Adequacy

Available engineering data pertaining to Forge Pond Dam is not adequate to be of significant assistance in the performance of a Phase I evaluation. A list of absent information is included in paragraph 7.1.b.

c. Validity

The validity of engineering data cannot be assessed due to the absence of data.

SECTION 3: VISUAL INSPECTION

3.1 Findings

a. General

The inspections of Forge Pond Dam were performed on December 17, 1980 and February 23, 1981 by staff members of Storch Engineers. A copy of the visual inspection check list is contained in Appendix 1. The following procedures were employed for the inspection:

1) The embankment of the dam, appurtenant structures and adjacent areas were examined.
2) The embankment and accessible appurtenant structures were measured and key elevations determined by surveyor's level.
3) The embankment, appurtenant structures and adjacent areas were photographed.

b. Dam

The embankment was severely overgrown with brush, weeds and trees. There were a few trees with diameters over 1 foot. The crest of the dam was somewhat irregular and the upstream face was also irregular apparently due to wave erosion. The downstream face of the dam formed by boulders was in fair condition. In one area, near the left end, the downstream face consisted of a grassed earth slope, in place of the boulders. The boulders forming the downstream side of the spillway were irregularly arranged as though they had been dumped. At the left end of the downstream side of the spillway a section of the boulders was displaced as though they had sloughed or had been removed. The exposed area was approximately

12 feet long. The condition of the concrete of the spillway appeared to be generally satisfactory, although a crude notch about 1 foot wide and 4 inches deep was observed.

c. Appurtenant Structures

Water was discharging over the stoplogs at the time of inspection. There was no water discharging over the spillway. The stoplogs form an auxiliary spillway in addition to an outlet works. The timber forming the groove for the stoplogs was partially treated and appeared to be in satisfactory condition. The stone masonry walls forming the sides of the outlet works discharge channel were in generally satisfactory condition. However, the left wall appeared to have bulged out from the embankment approximately four inches in an area within five feet of the top. Also, the concrete cap on each wall was cracked and the two walls had been repointed.

d. Seepage

Seepage was observed along the toe of dam in several locations and also in the stream bed immediately downstream from the spillway. The seepage was flowing very slightly at the time of inspection. Also, evidence of some leakage through the stone masonry wall immediately downstream from the stoplogs was observed.

e. Reservoir Area

The impoundment of the dam is 1100 feet long with a width varying from 400 to 1000 feet. The entire reservoir shore appeared to be wooded, with moderate slopes averaging approximately 5%. One homesite was observed along the left shore near the downstream end of the pond.

f. Downstream Channel

The downstream channel in the immediate vicinity of the dam is a stream with a rocky bottom and steep high banks with trees growing up to the stream sides. The downstream channel crosses Troy Road and Beverwyck Road at locations 1800 feet and 2500 feet downstream of the dam, respectively. A dwelling is located adjacent to the channel about 1800 feet from the dam and approximately 10 feet above the stream bed.

SECTION 4: OPERATIONAL PROCEDURES

4.1 Procedures

The level of water in Forge Pond is regulated by discharge over the concrete spillway weir and through the auxiliary spillway (outlet works) fitted with stoplogs. The outlet works (auxiliary spillway) of the dam can be used to drain the lake or to augment the discharge capacity of the spillway. At the time of inspection outflow from the pond was discharging through the stoplog controlled outlet works and not over the concrete spillway.

4.2 Maintenance of the Dam

It is not known when the dam was last maintained with the exception of the raising of the top of the dam in 1910.

4.3 Maintenance of Operating Facilities

It is not known when the outlet works was last serviced. Evidence of repair to the mortar in the stone masonry walls was observed at the time of inspection.

4.4 Description of Warning System

Reportedly, no warning system is currently in use for the dam.

4.5 Evaluation of Operational Adequacy

The operation of the dam has been successful to the extent that the dam reportedly has not been overtopped since the top of the dam was raised approximately two feet around 1910.

Reportedly, there has been only "as needed" maintenance over the years and no maintenance documentation could be obtained.

Areas of maintenance that have not been adequately performed are:

1) Upstream face of the embankment eroded due to wave action and not repaired.

2) Dam embankment severely overgrown with brush, weeds and trees.

3) Section of boulders on downstream side of the spillway displaced and not repaired.

4) Left wall of outlet works discharge channel appeared to have buckled out from the embankment and not repaired. Cracked concrete caps not repaired.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design Data

The quantity of storm water runoff that the spillway should be able to handle is based on the size and hazard classification of the dam. This runoff quantity , called the spillway design flood (SDF) is described in terms of return frequency or probable maximum flood (PMF) depending on the extent of the dam's size and potential hazard. According to the "Recommended Guidelines for Safety Inspection of Dams" published by the U.S. Army Corps of Engineers, the SDF for Forge Pond Dam falls in a range of 100-year frequency to 1/2 PMF. In this case, the low end of the range, 100-year frequency, is chosen since the factors used to select size and hazard classifications are on the low side of their respective ranges.

The SDF peak computed for Forge Pond Dam is 3678 c.f.s. This value is derived from the 100-year flood hydrograph computed by the use of the HEC-1-DAM Hydrograph Computer Program using the Soil Conservation Service triangular unit hydrograph method with the curvilinear transformation. Hydrologic computations and computer output are contained in Appendix 4.

The spillway discharge rates were computed by the use of weir formulae appropriate for the configurations of the spillway and auxiliary spillway. The combined spillway and auxiliary spillway discharge with lake level equal to the top of the dam was computed to be 653 c.f.s. The SDF was routed through the dam by use of the HEC-1-DAM computer program using the modified Puls Method. In routing the SDF, it was found that the dam crest would be overtopped by a depth of 2.1 feet. Accordingly, the subject spillways are assessed as being inadequate in accordance with criteria developed by the U.S. Army Corps of Engineers.

b. Experience Data

Reportedly, the dam has never been overtopped, no damage to downstream structures has been reported.

c. Visual Observation

No evidence of overtopping of the embankment was noted at the times of inspection.

d. Overtopping Potential

As indicated in paragraph 5.1.a. a storm of magnitude equal to the SDF would cause overtopping of the dam to a height of 2.1 feet over the crest of the dam. The spillways are capable of passing approximately 18 percent of the SDF with lake level equal to the top of dam.

e. Drawdown Data

Draw down of the lake is accomplished by removing the timber stoplogs in the outlet works. Total time for drawdown is estimated to be 33 hours. (See Appendix 4).

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

The dam appeared, at the time of inspection, to be outwardly stable. However, evidence of possible embankment distress was noted at the times of inspection. Seepage was observed at several locations, some boulders on the downstream side of the spillway were displaced and one of the walls forming the outlet works was displaced. The seepage along the toe of the dam appeared to have been active for many years. The severity of the seepage cannot be precisely determined within the scope of this Phase I evaluation. However, neither the seepage nor the other signs of distress appear to be an indication of immediate structural instability.

b. Generalized Soils Description

The generalized soils description of the dam site consists of glacial ground moraine composed of unstratified materials deposited during the Wisconsin glaciation. The moraine consists of silt and silty sand with pebbles, cobbles, and boulders present throughout the profile.

c. Design and Construction Data

Analysis of structural stability and construction data for the embankment are not available.

d. Operating Records

No operating records are available for the dam. The water level of Forge Pond is not monitored.

e. Post-Construction Changes

Reportedly, the dam crest was raised approximately two feet around 1910.

f. Seismic Stability

Forge Pond Dam is located in Seismic Zone 1 as defined in "Recommended Guidelines for Safety Inspection of Dams" which is a zone of very low seismic activity. Experience indicates that dams in Seismic Zone 1 will have adequate stability under seisimc loading conditions if they have adequate stability under static loading conditions. Forge Pond Dam appeared to be outwardly stable under static loading conditions. Forge Pond Dam appeared to be outwardly stable under static loading conditions at the time of inspection.

SECTION 7: ASSESSMENT AND RECOMMENDATIONS

7.1 Dam Assessment

a. Safety

Based on hydraulic and hydrologic analyses outlined in Section 5 and Appendix 4, the spillways of Forge Pond Dam are assessed as being inadequate. The spillways are not able to pass the SDF without an overtopping of the dam.

The embankment appeared, at the time of inspection, to be outwardly stable. However, evidence of possible distress was observed. The evidence consisted of seepage, displaced boulders at the spillway structure and a displaced wall forming the outlet works.

b. Adequacy of Information

Information sources for this report include 1) field inspections, 2) USGS quadrangle, 3) consultation with ex-mayor of the Township of Parsippany-Troy Hills, 4) consultation with personnel of the Township of Parsippany-Troy Hills. The information obtained is sufficient to allow a Phase I assessment as outlined in "Recommended Guidelines for Safety Inspection of Dams."

Some of the absent data are as follows:

1. Construction and as-built drawings.
2. Description of fill material for embankment.
3. Design computations and reports.
4. Maintenance documentation.
5. Soils report for the site.
6. Post construction engineering reports.

c. Necessity for Additional Data/Evaluation

Although some data pertaining to Forge Pond Dam are not available, additional data are not considered imperative for this Phase I evaluation.

7.2 Recommendations

a. Remedial Measures

Based on hydraulic and hydrologic analyses outlined in paragraph 5.1.a, the spillways are considered to be inadequate. It is therefore recommended that a professional engineer experienced in the design and construction of dams be engaged in the near future to perform more accurate hydraulic and hydrologic analyses relating to the spillway capacity. Based on the findings of these analyses, the need for and type of remedial measures should be determined and then implemented.

The owner should, in the near future, develop an emergency action plan together with an effective warning system outlining actions to be taken by the operator to minimize downstream effects of an emergency at the dam.

It is further recommended that the following remedial measures be undertaken by the owner in the near future.

1) The upstream face of the dam should be properly protected against erosion.

2) The downstream side of the spillway structure should be properly protected and supported in the area of displaced boulders.

3) The stone masonry walls of the outlet works should be properly supported or reconstructed.

4) All trees and adverse vegetation on the embankment should be removed.

b. Maintenance

In the near future, the owner of the dam should develop written operating procedures and a periodic maintenace plan to ensure the safety of the dam.

c. Additional Studies

Seepage at the dam should be periodically monitored in order to detect any changes in its severity or its effects on the structural stability of the dam.

PLATES

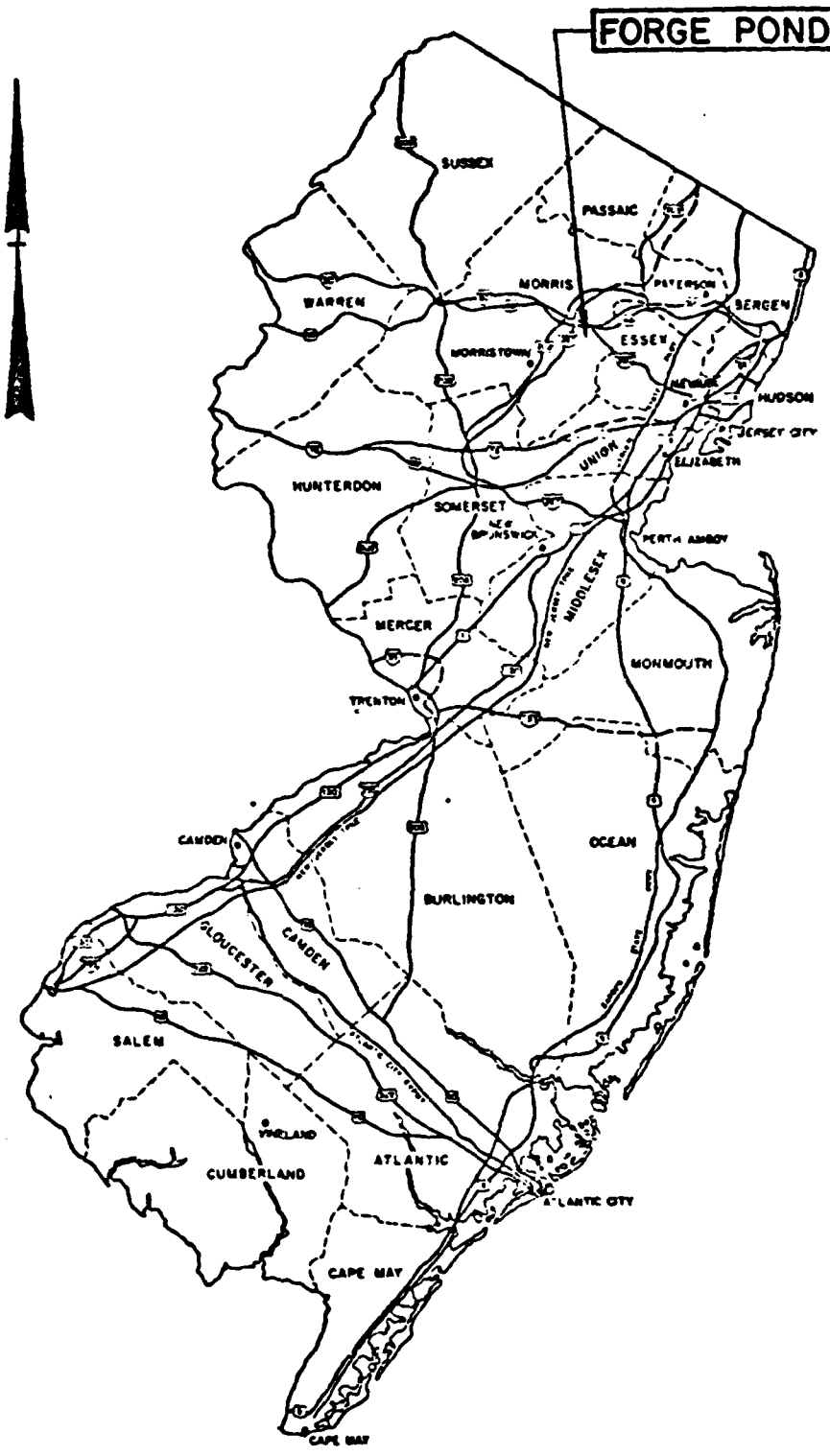
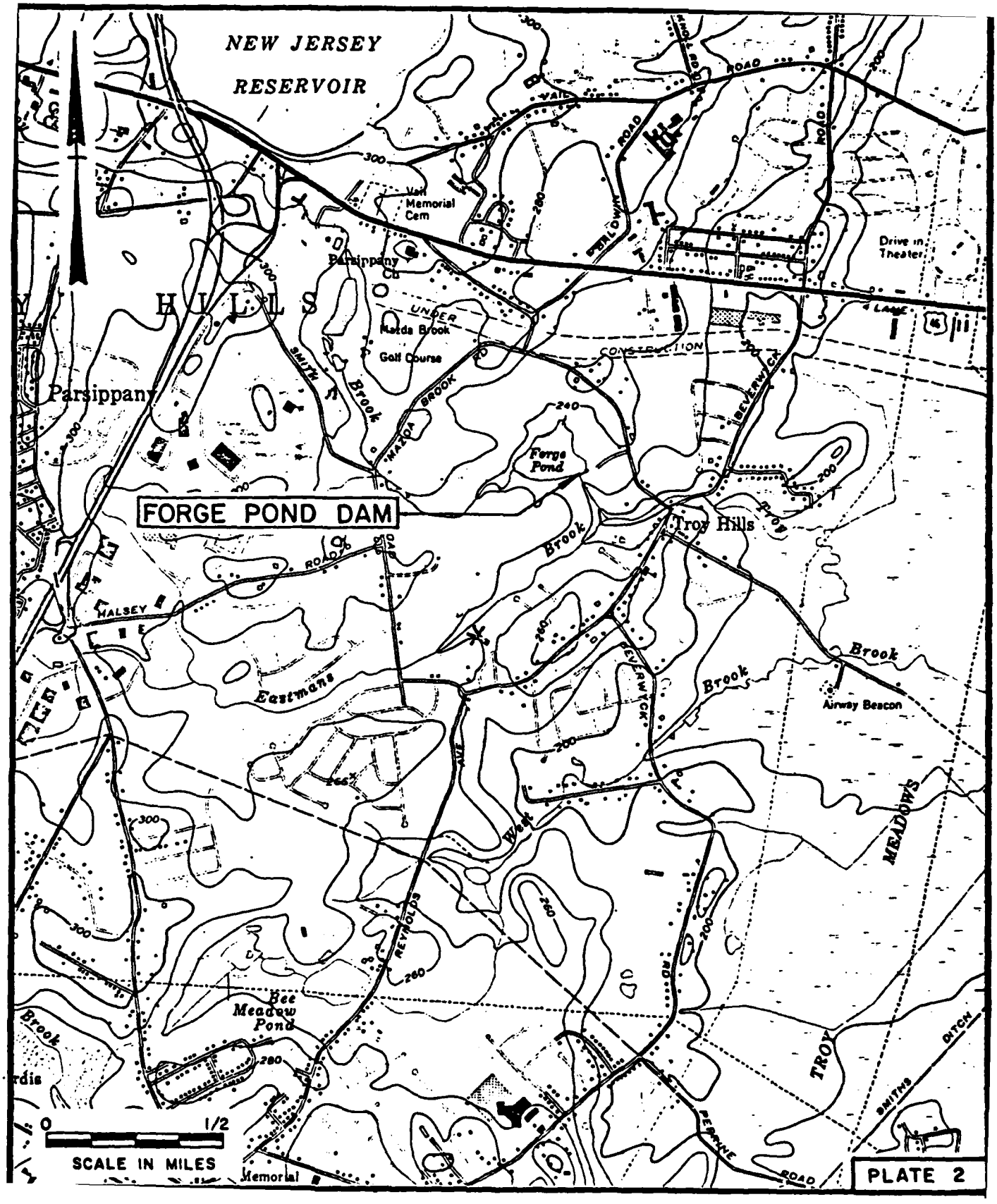
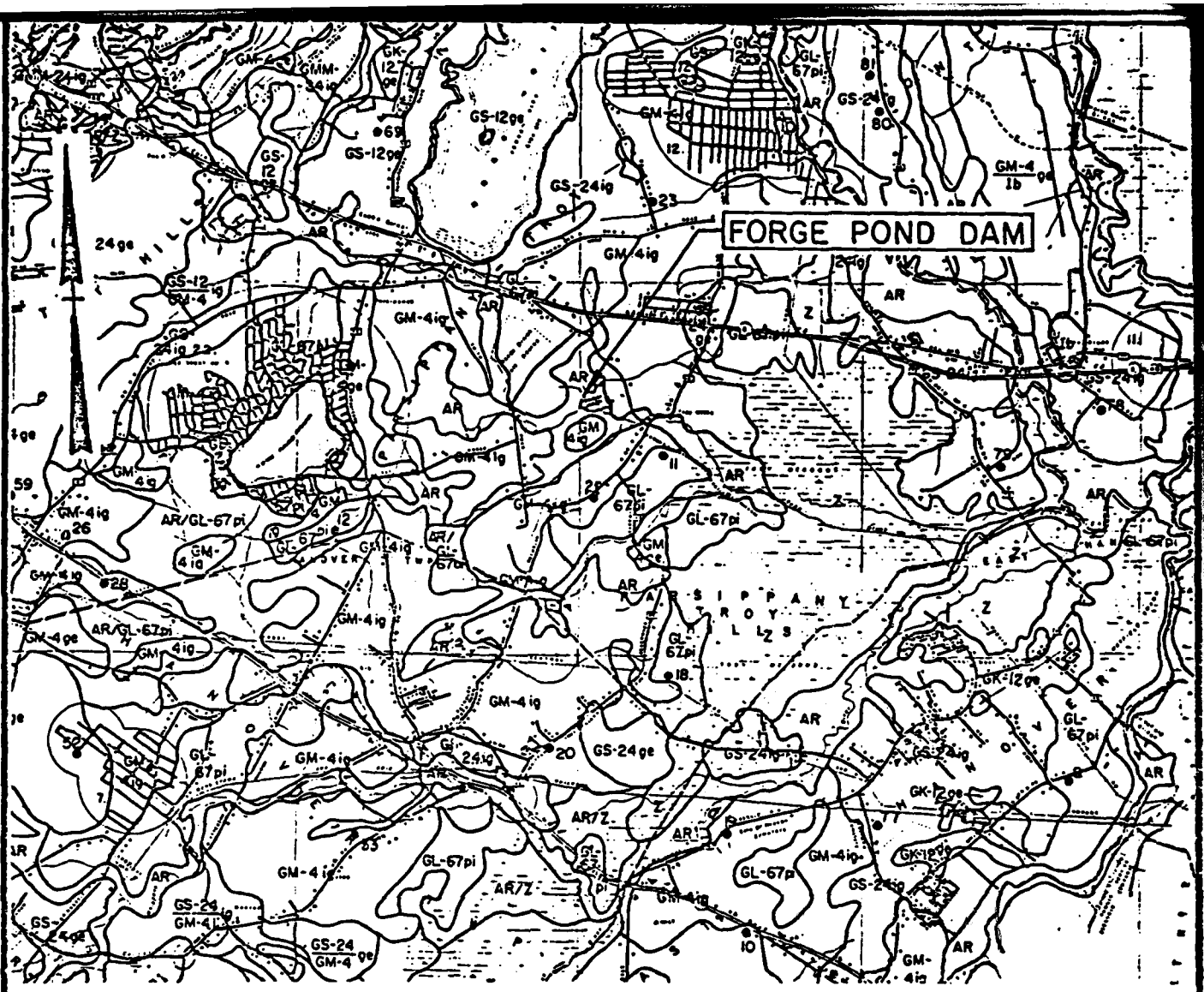


PLATE 1

STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	INSPECTION AND EVALUATION OF DAMS KEY MAP FORGE POND DAM
DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY	SCALE: NONE DATE: FEB. 1981


NEW JERSEY
RESERVOIR
HILLS
Parsippany
FORGE POND DAM
Forge Pond
Troy Hills
Golf Course
Drive in Theater
Airway Beacon
Eastmans
Bee Meadow Pond
MEADOWS
Memorial
SCALE IN MILES
0
1/2
PLATE 2



Legend

AR — Recent alluvium, composed of stratified materials deposited by streams.

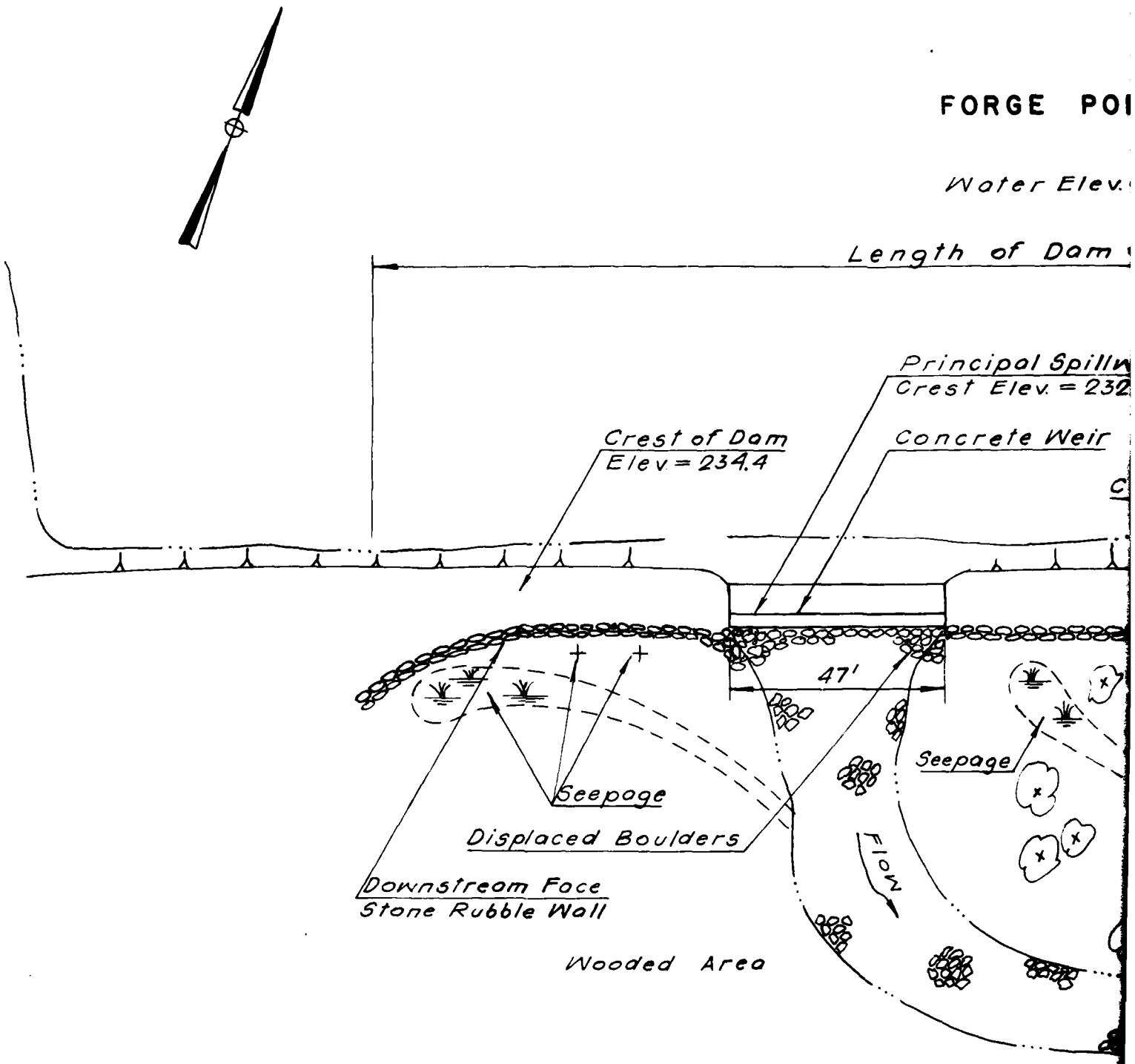
GM-4 — Glacial ground moraine composed of unstratified material deposited during the Wisconsin glaciation overlying a soft red shale with sandstone bed.

Note: Information taken from: Rutgers University, Engineering Soil Survey of New Jersey, Report No. 9, Morris County, November 1953 and Geologic Map of New Jersey prepared by J. V. Lewis and H. Kummel 1910-1912, revised by H. B. Kummel 1931 and M. Johnson 1950.

PLATE 3

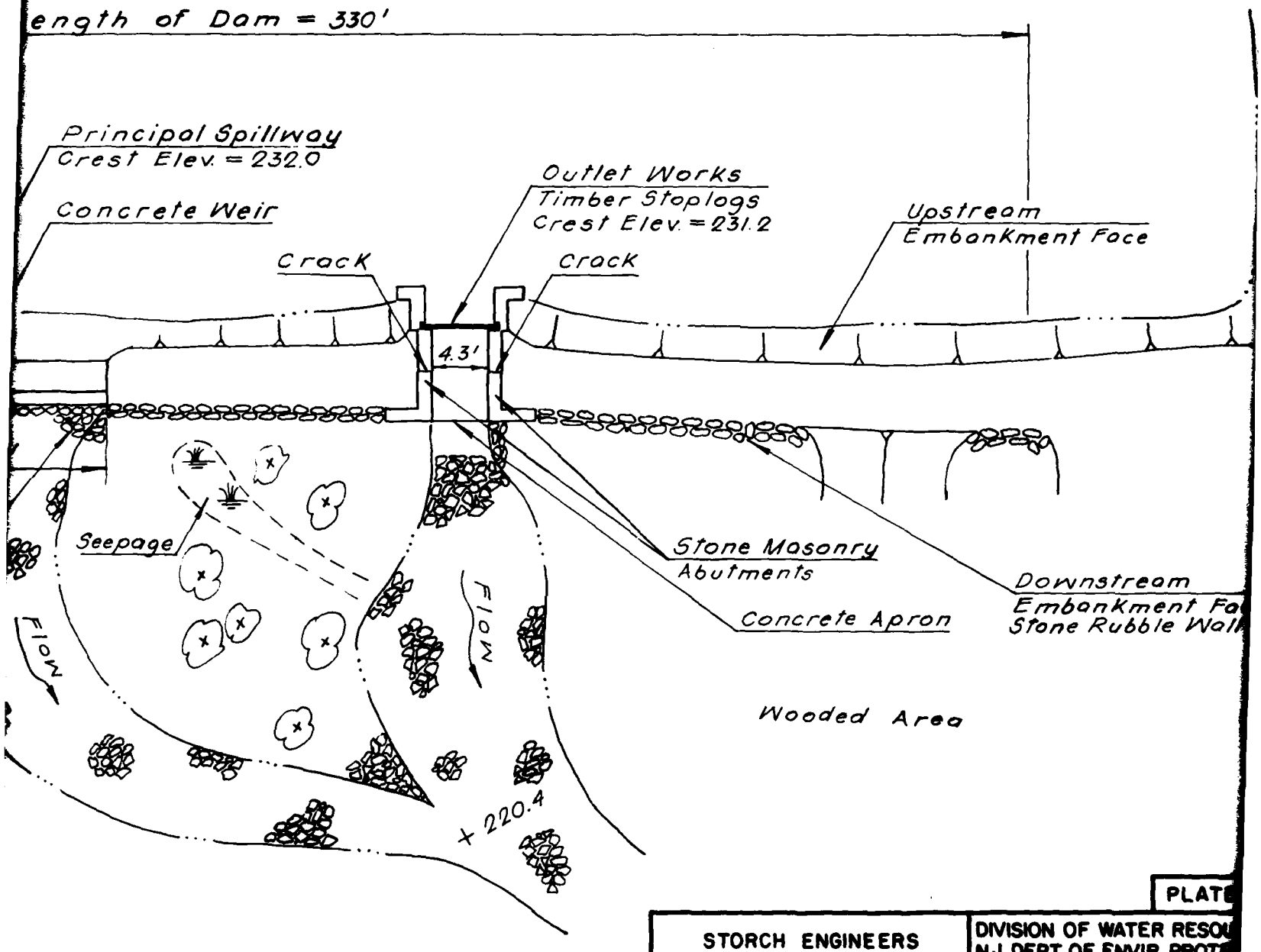
STORCH ENGINEERS FLORHAM PARK, NEW JERSEY.	INSPECTION AND EVALUATION OF DAMS SOIL MAP FORGE POND DAM
DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY.	SCALE: NONE DATE: FEB.1981

FORGE POI



Note:
Information taken from field inspections
December 17, 1980 and February 23, 1981

FORGE POND



PLATE

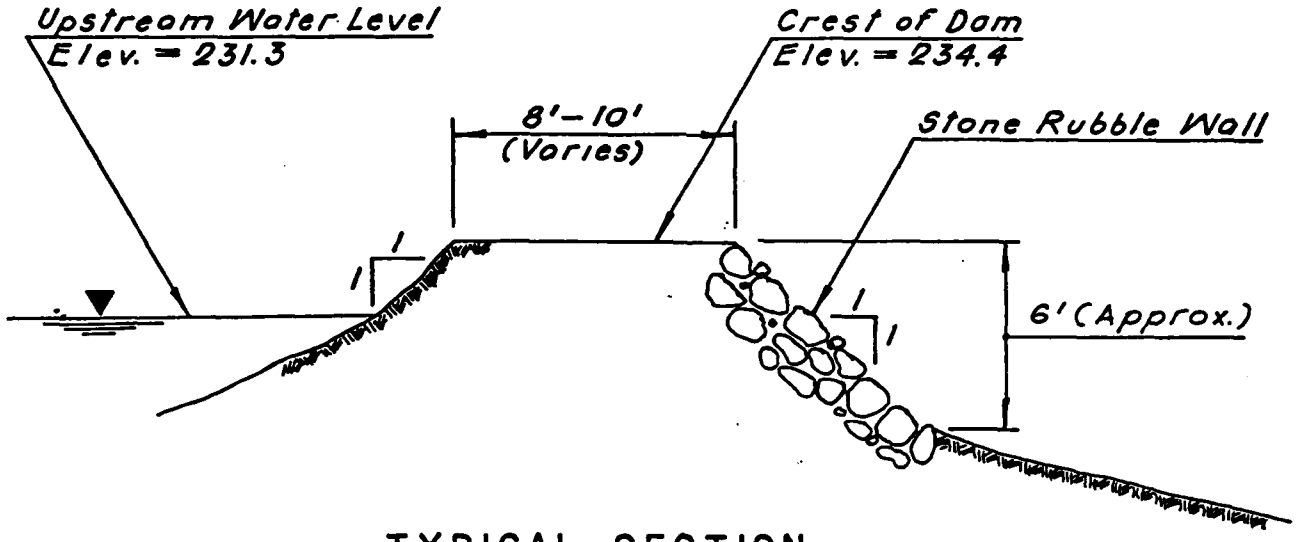
STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	DIVISION OF WATER RESOU N.J. DEPT. OF ENVIR. PROTE TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS

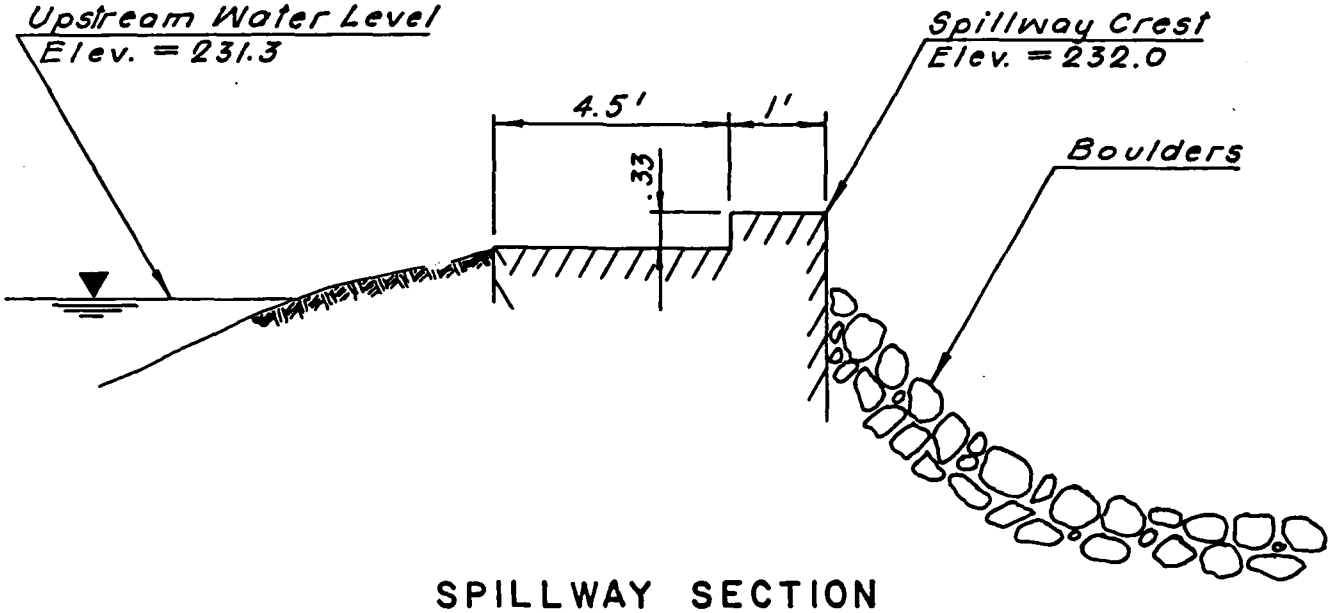
GENERAL PLAN

FORGE POND DAM

I.D. N.J. 00807	SCALE: NOT TO SCALE
	DATE: FEB. 1981



TYPICAL SECTION

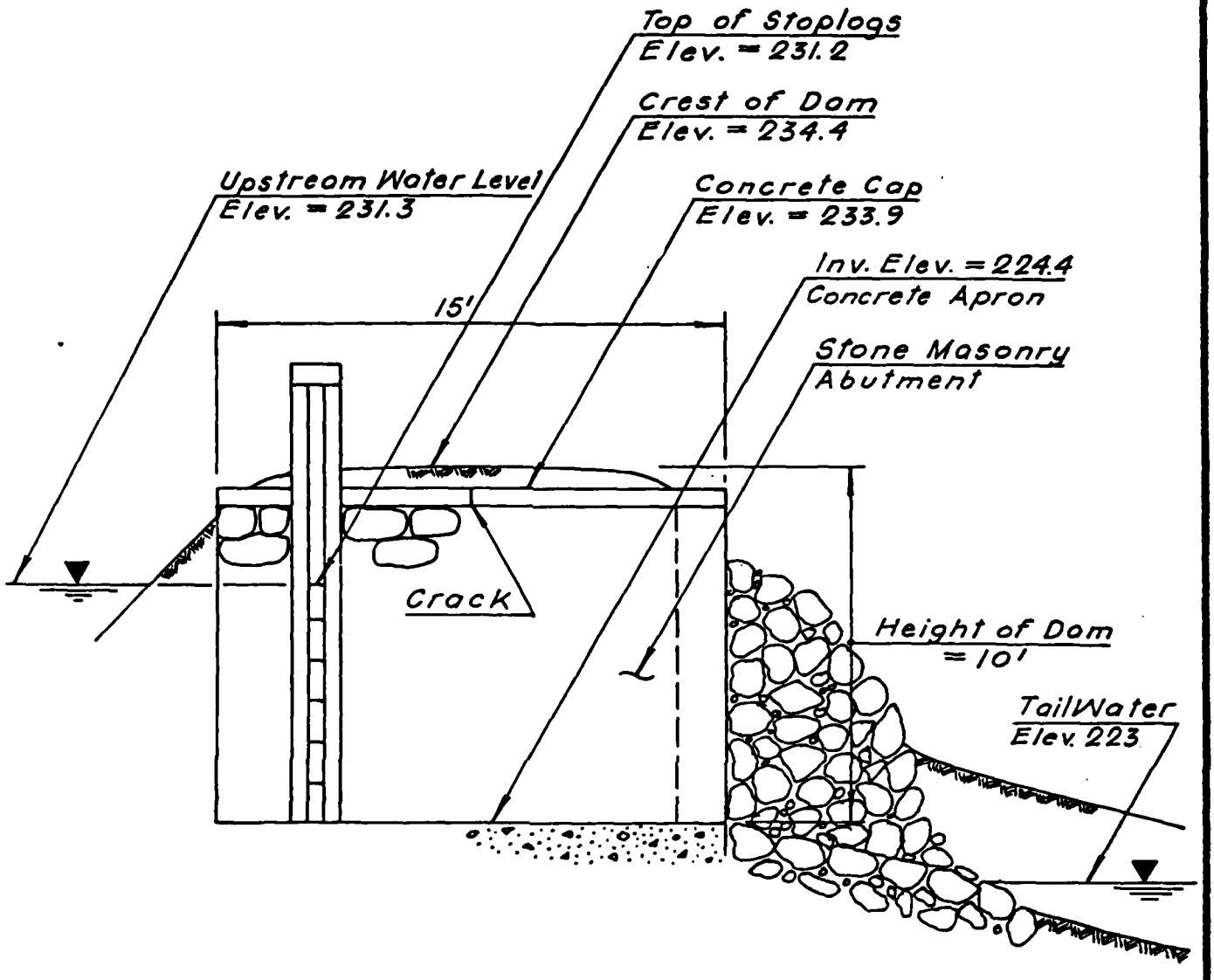


SPILLWAY SECTION

Note:
Information taken from field inspections December 17, 1980 and February 23, 1981

PLATE 5

STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	INSPECTION AND EVALUATION OF DAMS SECTIONS FORGE POND
DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY	I.D. N.J. 00807 | SCALE: NONE DATE: FEB. 1981



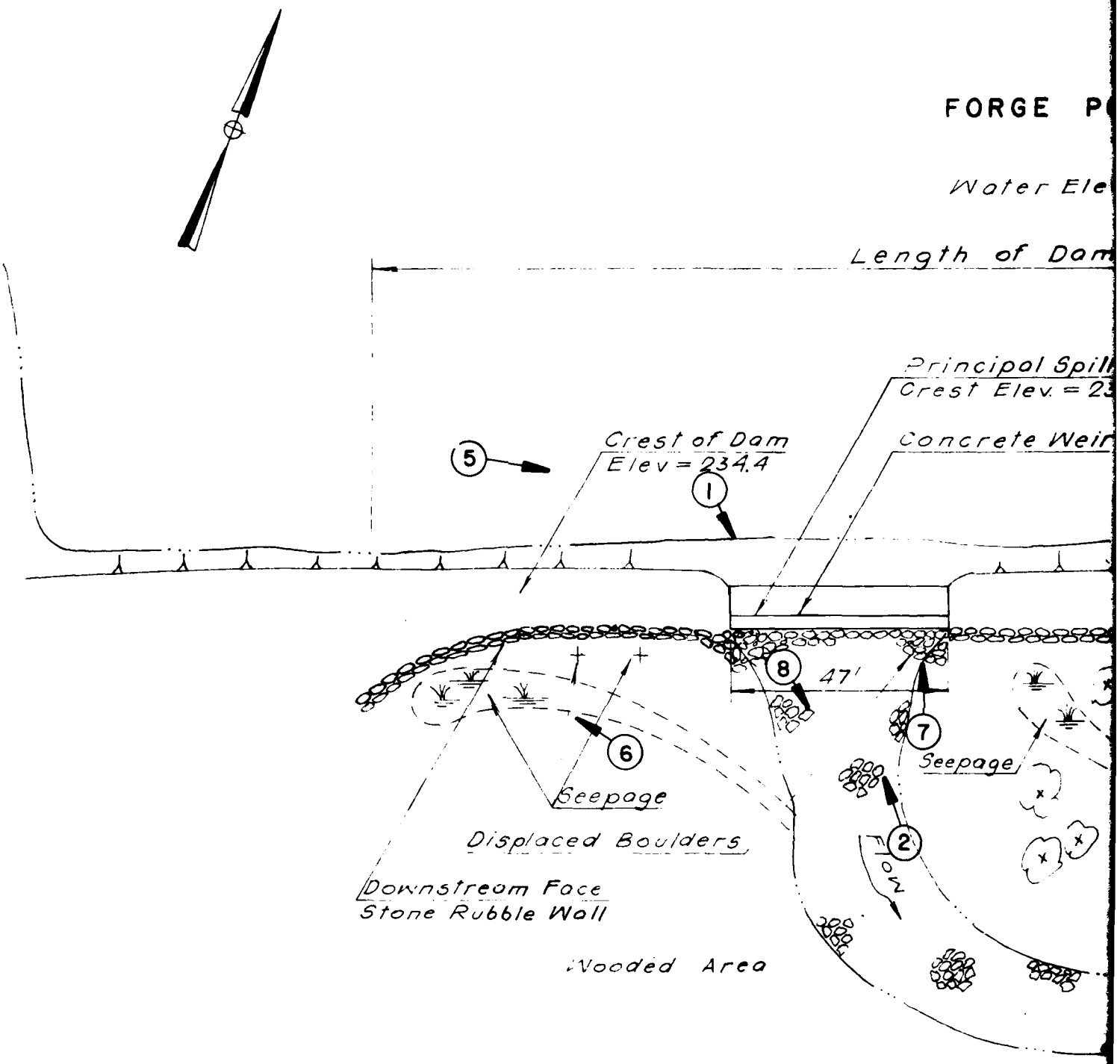
OUTLET WORKS SECTION

Note:
Information taken from field inspections
December 17, 1980 and February 23, 1981

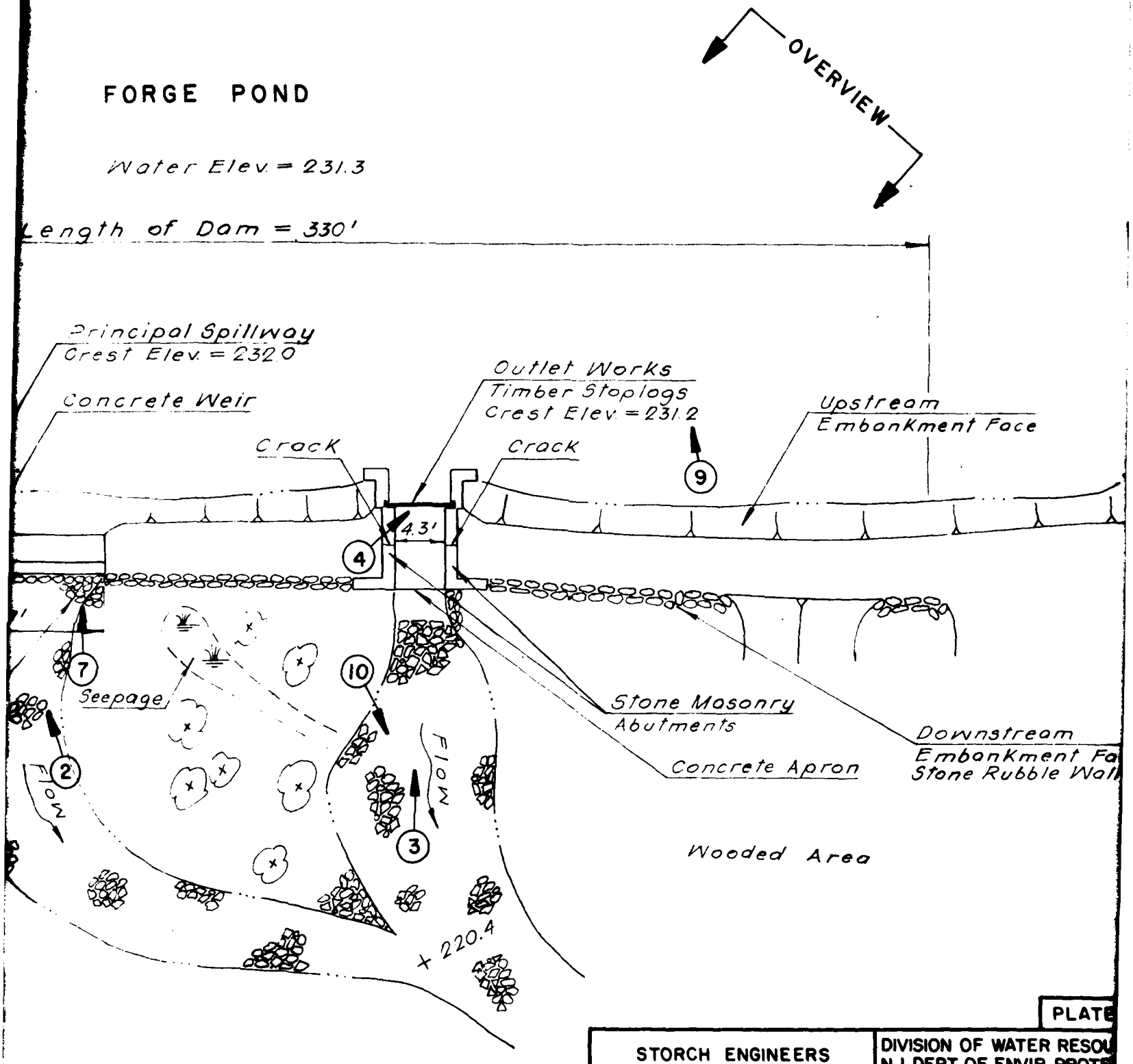
PLATE 6

STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	INSPECTION AND EVALUATION OF DAMS OUTLET WORKS SECTION FORGE POND
DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY	I.D. N.J. 00807 / SCALE: NONE DATE: FEB. 1981

FORGE P



Note:
Information taken from field inspections
December 17, 1980 and February 23, 1981



PLATE

STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	DIVISION OF WATER RESOU N.J. DEPT. OF ENVIR. PROTE TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS

PHOTO LOCATION PLAN

FORGE POND DAM

I. D. N.J. 00807	SCALE: NOT TO SCALE
	DATE: FEB. 1981

APPENDIX 1

Check List - Visual Inspection

Check List - Engineering Data

Check List

Visual Inspection

Phase I

Name of Dam Forge Pond Dam County Morris State N.J. Coordinators NJDEP

Date(s) Inspection 12/17/80 ~~2/23/81~~ Weather Sunny ~~Cloudy, Rain~~ Temperature 25°F ~~40°F~~

Pool Elevation at time of Inspection 231.2 M.S.L. Tailwater at Time of Inspection 223.0 M.S.L.

Inspection Personnel:

John Gribbin
Richard McDermott
Charles Osterkorn
Daniel Buckelew

John Gribbin Recorder

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
GENERAL	Severely overgrown with brush, weeds and trees. Downstream face formed by large boulders (30"dia.) generally neatly placed but in fair condition.	Trees and adverse vegetation should be removed.
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Junctions at spillway stabilized by large boulders and appeared to be stable.	
ANY NOTICEABLE SEEPAGE	Seepage in form of standing water observed at several locations along toe. Standing water not frozen - lake water frozen. Seepage appeared to have formed streams leading to downstream channel.	Seepage appeared to be long standing condition. Seepage should be monitored on a periodic basis.
STAFF GAGE AND RECORDER	None observed.	
DRAINS	None observed.	

EMBANKMENT

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None observed.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Upstream face and crest irregular due to erosion.	Erosion appeared to be due to wave action and runoff. Slope protection should be improved.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Vertical: generally level Horizontal: irregular	
RIPRAP	Riprap observed on upstream face of embankment - could not be observed below waterline.	Adequacy could not be assessed.

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SURFACES IN OUTLET CONDUIT	Stone masonry walls forming sides of discharge channel in generally satisfactory condition with section of left wall within five feet of top leaning outward from embankment approx. 4". Repair of mortar in walls observed. Large crack in concrete cap of each wall, approx. 1" wide.	Wall should be repaired.
INTAKE STRUCTURE	N/A	
OUTLET STRUCTURE	N/A	
OUTLET CHANNEL	Natural channel with boulder lined bottom, appeared to be satisfactorily protected against erosion.	
GATE AND GATE HOUSING	Timber stoplogs in generally satisfactory condition. Timber channels in which stoplogs were fitted appeared to be in satisfactory condition.	Lake discharging over stoplogs at time of inspection.

SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
WEIR	Concrete surfaces in satisfactory condition. Crude notch observed in crest, approx. 1' wide, 4" deep.	
APPROACH CHANNEL	N/A	
DOWNSTREAM FACE	Downstream face formed by irregular array of large boulders (up to 40"). Section of boulders at left end of weir missing, causing downstream side of weir to be exposed for length of approx. 12'.	Missing boulders should be replaced.
DISCHARGE CHANNEL	Natural stream with bottom lined with boulders. Boulders appeared to provide adequate erosion protection.	

INSTRUMENTATION

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None	
OBSERVATION WELLS	None	
WEIRS	None	
PIEZOMETERS	None	
OTHER		

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Shores wooded with moderate slope of approx. 5%.	
SEDIMENTATION	Unknown	
STRUCTURES ALONG BANKS	One homesite observed on left shore.	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTION, DEBRIS, ETC.)	Natural meandering stream with cobbly bottom and wooded along both banks.	
SLOPES	Banks generally steep and high.	
STRUCTURES ALONG BANKS	Road bridges located 1600' and 2200' downstream. Dwelling adjacent to channel located 1800' downstream, approx. 10' above stream bed.	

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM			REMARKS
DAM	-	PLAN	Not Available
		SECTIONS	
SPILLWAY	-	PLAN	Not Available
		SECTIONS	
		DETAILS	
OPERATING EQUIPMENT PLANS & DETAILS			Not Available
OUTLETS	-	PLAN	Not Available
		DETAILS	
		CONSTRAINTS	
		DISCHARGE RATINGS	
HYDRAULIC/HYDROLOGIC DATA			Not Available
RAINFALL/RESERVOIR RECORDS			Not Available
CONSTRUCTION HISTORY			Not Available
LOCATION MAP			Not Available

ITEM	REMARKS
DESIGN REPORTS	Not Available
GEOLOGY REPORTS	Not Available
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM INSTABILITY SEEPAGE STUDIES	Not Available
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	Not Available
POST-CONSTRUCTION SURVEYS OF DAM	Not Available
BORROW SOURCES	Not Available

ITEM	REMARKS
MONITORING SYSTEMS	Not Available
MODIFICATIONS	Not Available
HIGH POOL RECORDS	Not Available
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	Not Available
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	Not Available
MAINTENANCE OPERATION RECORDS	Not Available

APPENDIX 2

Photographs

PHOTO 1

UPSTREAM FACE OF PRINCIPAL SPILLWAY

PHOTO 2

DOWNSTREAM FACE OF PRINCIPAL SPILLWAY

FORGE POND DAM
17 DECEMBER 1980

PHOTO 3

OUTLET WORKS

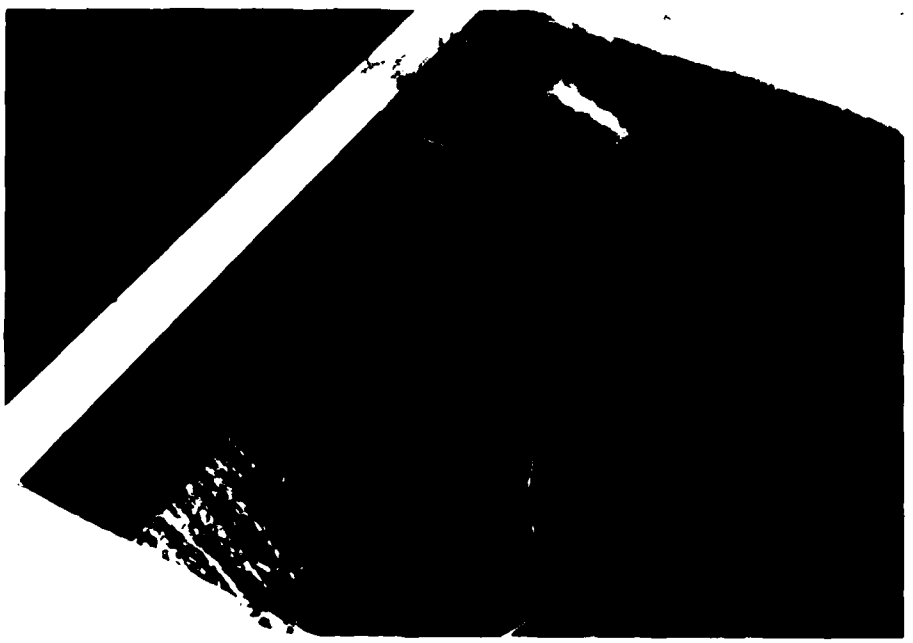


PHOTO 4

DISCHARGE OVER STOPLOGS IN OUTLET WORKS

FORGE POND DAM
17 DECEMBER 1980

PHOTO 5

UPSTREAM FACE OF DAM

PHOTO 6

DOWNSTREAM FACE OF DAM WITH SEEPAGE AT TOE

FORGE POND DAM

17 DECEMBER 1980

PHOTO 7

DOWNSTREAM SIDE OF PRINCIPAL SPILLWAY CREST
EXPOSED BY DISPLACEMENT OF BOULDERS

PHOTO 8

DISCHARGE CHANNEL FOR PRINCIPAL SPILLWAY

FORGE POND DAM

17 DECEMBER 1980

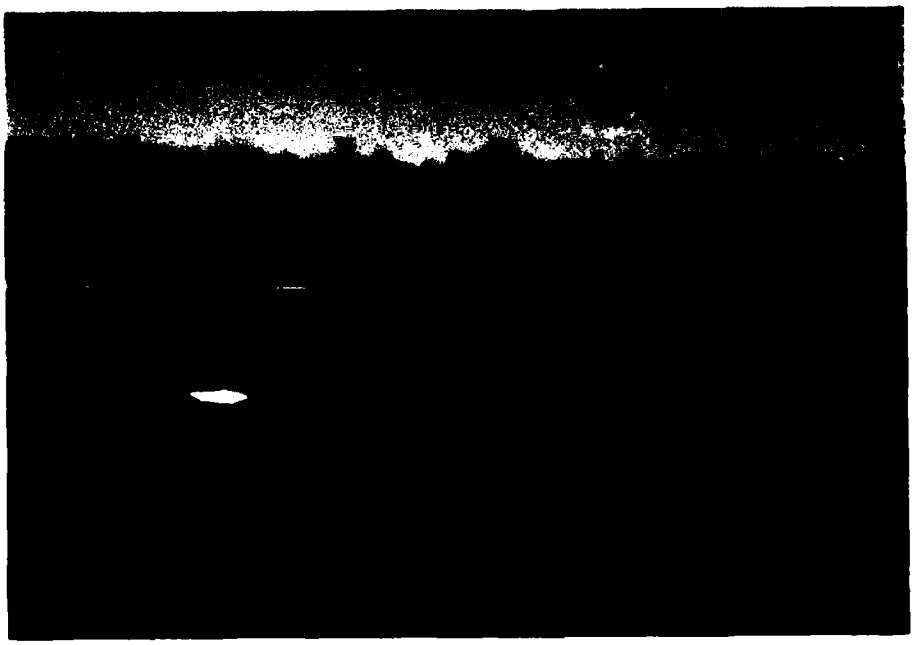


PHOTO 9

FORGE POND

PHOTO 10

DOWNSTREAM CHANNEL AT OUTLET WORKS

FORGE POND DAM

17 DECEMBER 1980

APPENDIX 3

Engineering Data

CHECK LIST

HYDROLOGIC AND HYDRAULIC DATA

ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: Wooded and residential

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 231.2

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): N/A

ELEVATION MAXIMUM DESIGN POOL: 236.5

ELEVATION TOP DAM: 234.4

PRINCIPAL SPILLWAY CREST: Uncontrolled Concrete Weir

a. Elevation 232.0

b. Type Broad Crested Weir

c. Width 1.0 feet

d. Length 47 feet

e. Location Spillover Downstream side of dam

f. Number and Type of Gates N/A

AUXILIARY SPILLWAY CREST: Controlled Weir (Stoplogs)

a. Elevation 231.2

b. Type Sharp Crested Weir

c. Width 0.1 ft.

d. Length 4.3 ft.

e. Location Spillover Upstream side of dam

f. Number and Type of Gates One set stoplogs

OUTLET WORKS: (Auxilliary Spillway)

a. Type Removeable stoplogs

b. Location Upstream side of dam, 100ft. from left end

c. Entrance Invert 224.4

d. Exit Invert 224.4

e. Emergency Draindown Facilities: Remove stoplogs

HYDOMETEOROLOGICAL GAGES: NONE

a. Type N/A

b. Location N/A

c. Records N/A

MAXIMUM NON-DAMAGING DISCHARGE:

(Lake Stage Equal to Top of Dam) 653 c.f.s.

APPENDIX 4

Hydraulic/Hydrologic Computations

STORCH ENGINEERS

Project FORGE POND DAM

Sheet 1 of 12

Made By JLP Date 1-20-81

Chkd By JG Date 2/12/81

HYDROLOGY

Hydrologic Analysis

Runoff hydrograph will be developed by HEC-1-DAM computer program using SCS triangular hydrograph with the curvilinear transformation

Drainage Area = 6.56 SQ. MI.

Infiltration Data

Initial Infiltration	1.5 inches
Constant Infiltration	0.15 inches/hour

Time of Concentration (t_c) (Method #1)

By SCS TR-55

OVERLAND Flow	6000'
AVER. Slope	5.33 %
AVER. Velocity	0.57 F.P.S.
Time of Concentration	2.92 HR.
Channel Flow	23,000'
AVER. Slope	0.70 %
AVER. Velocity	1.70 F.P.S.
Time =	3.76 HR.
+ =	6.68 HR.

TIME of Concentration (Method #2)

by Kerby Pg. 14-36 "HANDBOOK of APPLIED HYDROLOGY" CHow

$$T_c^{2.14} = \frac{2}{3}\frac{Ln}{\sqrt{S}}$$

T_c = Time of Concentration
L = Length of Flow
S = Slope
n = Roughness Coeff.

OVERLAND Flow:

L = 6,000'
S = 0.0533
n = 0.40
Time = 1.04 Hr.

Channel Flow:

L = 23,000'
S = 0.0070
n = 0.10
Time = 1.64 Hr.
t_c = 2.68 Hr.

TIME of CONCENTRATION (Method #3)

N.J. Highway Authority & D.E.P. Nomographs

Overland Flow L = 6,000'
S = 5.33%
AVER. GRASS
Time = 0.90 Hr.

N.J. Highway & D.E.P. Nomographs (cont.)

Channel Flow: L = 23,000'
ΔELEV. = 160'
time = 2.0 Hr.
t_c = 2.90 Hr.

Time of Concentration (Method #4)

By p. 70 U.S. Dept. of Interior "Design of Small Dams" Texas Highway Dept. & Navlocks TP-PW-5

Overland Flow:
L = 6000'
S = 5.33%
V = 2.00 F.P.S.
time = 0.83 Hr.

Channel Flow:
L = 23,000'
S = 0.70%
V = 1.5 F.P.S.
time = 4.26 Hr.
t_c = 5.09 Hr.

Time of Concentration and Lag Time

T_c use 5.0 Hr.

Lag = 0.6 T_c = 3.0 Hr.

Precipitation

24 Hour, 100-Year Rainstorm Distribution for Forge Pond Dam

Time (Hr.)	Rain (inches)
1	0.075
2	0.075
3	0.075
4	0.075
5	0.075
6	0.075
7	0.075
8	0.075
9	0.075
10	0.075
11	0.075
12	0.075
13	0.15
14	0.15
15	0.15
16	0.33
17	0.65
18	3.00
19	0.65
20	0.33
21	0.33
22	0.15
23	0.15
24	0.15
	7.09 inches

ELEVATION AREA TABLE

ELEV. (NGVD)	AREA (AC.)
224.4	0
231.2	9.18
240.0	34.89

HEC-1- DAM Computer program will develop storage capacity from surface areas & elevations

Information taken from USGS Quadrangle.

HYDRAULICS

Stage Discharge Calculation

Spillway Capacity:

The spillways at Forge Pond Dam consist of the following: The principal spillway is a broad crested concrete weir with an effective length of 47.0'. The auxillary spillway is formed by the outlet works and is a sharp crested weir with an effective length of 4.3'. Discharge Q, can be calculated by:

$$Q = CLh^{3/2}$$

where:

Q = discharge over spillway
C = discharge coefficient
L = effective length of spillway
h = total head on spillway

Values for the discharge coefficient, "C" were taken from the "Handbook of Hydraulics" by King & Brater.

STORCH ENGINEERS

Sheet 7 of 12

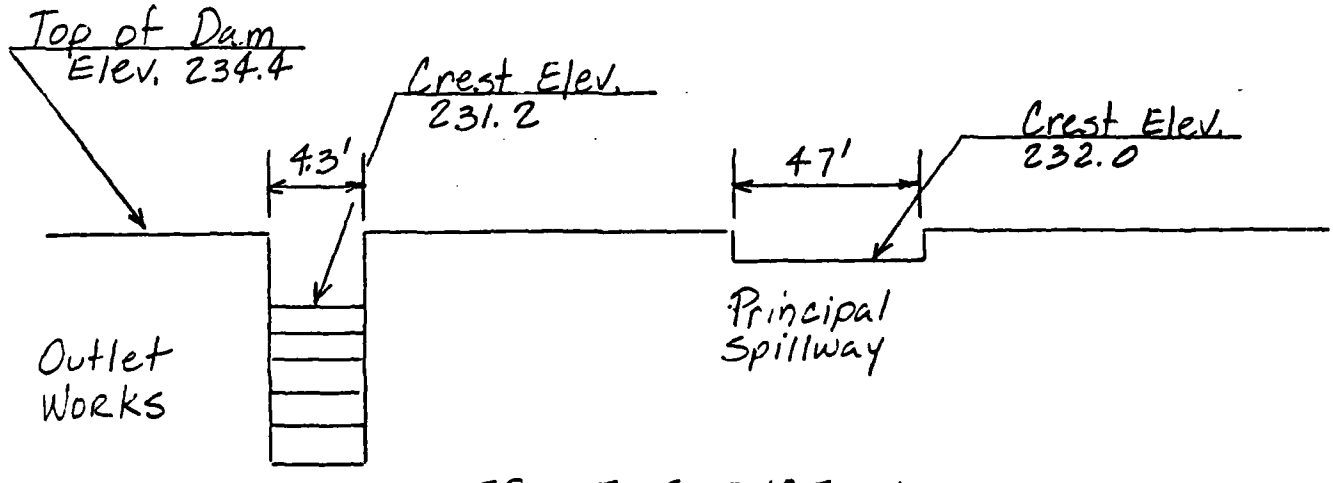
Project FORGE POND DAM

Made By JLP Date 1-20-81

Chkd By JG Date 2/12/81

SPILLWAY
STAGE DISCHARGE TABULATION

	PRINCIPAL SPILLWAY			OUTLET WORKS			TOTAL DISCHARGE
ELEV.	H(ft.)	Q(cfs)	"C"	H(ft.)	Q(cfs)	"C"	(cfs)
231.24	0	0	—	0	0	3.33	0
232.00	0	0	—	0.76	10	3.33	10
233.00	1.0	129	2.75	1.76	38	3.33	167
234.40	2.4	573	3.28	3.16	80	3.33	653
235.00	3.0	811	3.32	3.76	104	3.33	915
236.00	4.0	1248	3.32	4.76	149	3.33	1397
237.00	5.0	1745	3.32	5.76	198	3.33	1943
238.00	6.0	2293	3.32	6.76	252	3.33	2545
239.00	7.0	2889	3.32	7.76	310	3.33	3199
240.00	8.0	3531	3.32	8.76	371	3.33	3902



FRONT ELEVATION

STORCH ENGINEERS

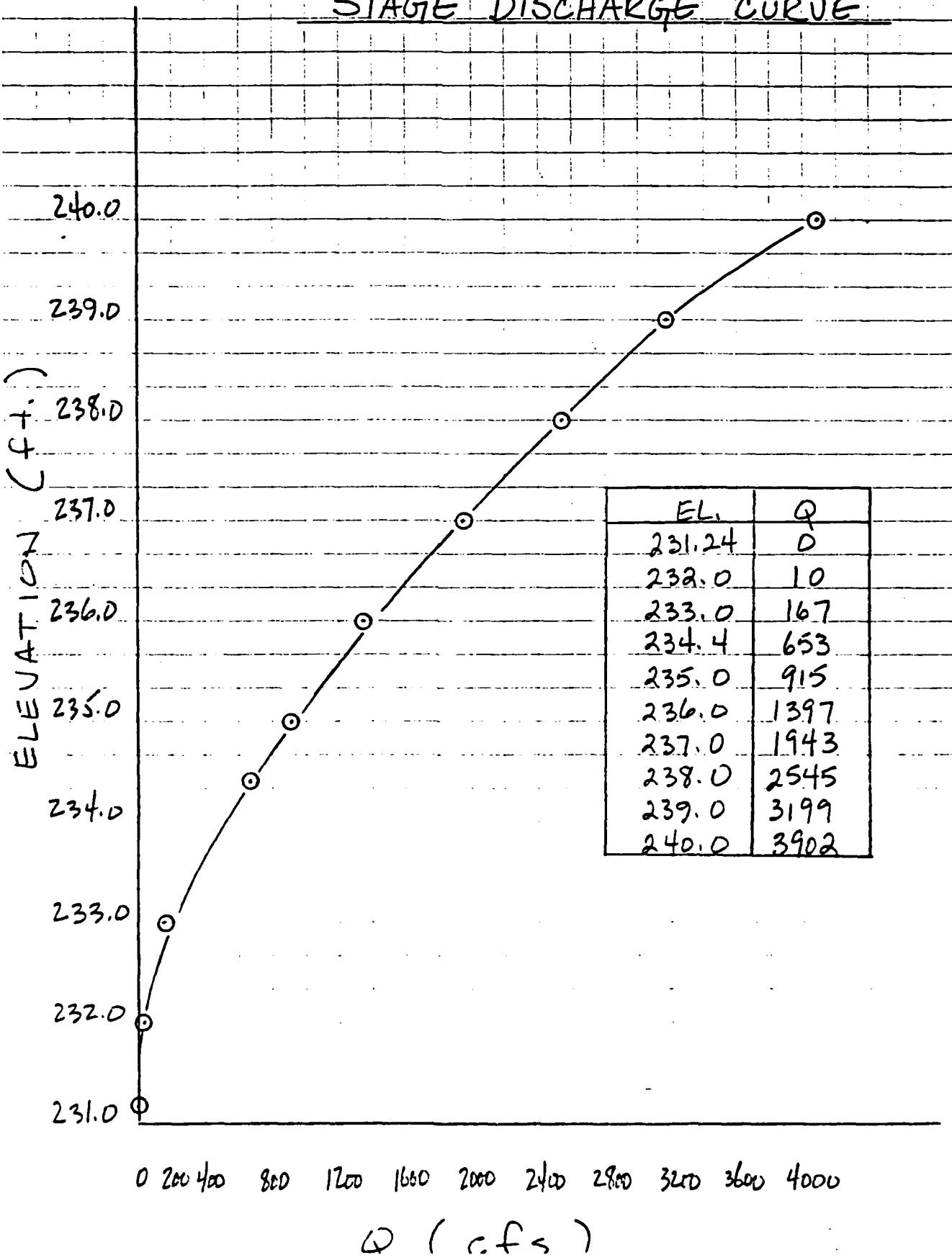
Project FORGE POND DAM

Sheet 8 of 12

Made By JLP Date 1-20-81

Chkd By JG Date 2/12/81

SPILLWAY STAGE DISCHARGE CURVE



EL.	Q
231.24	0
232.0	10
233.0	167
234.4	653
235.0	915
236.0	1397
237.0	1943
238.0	2545
239.0	3199
240.0	3902

OUTLET WORKS CAPACITY

OUTLET WORKS FOR THE FORGE POND DAM CONSIST OF A SHARP CRESTED WEIR WITH AN EFFECTIVE LENGTH OF 4.3'. DISCHARGE Q, CAN BE CALCULATED BY: $Q = CLh^{3/2}$

$C = 3.33$, $L = 4.3$, $h = 2.0'$

$$Q = \left[(3.33)(4.3)(2.0)^{3/2}\right] = 40.50 \text{ cfs}$$

AVG. DISCHARGE; $h = 0'$ to $h = 2.0'$
$Q = 20.25$ cfs

Drawdown will be based on 2' of stoplogs removed at a time.

DRAWDOWN TIME

$$\text{DRAWDOWN} = \frac{\text{STORAGE AT SPILLWAY}}{\text{AVERAGE DISCHARGE} - \text{AVG. INFLOW}}$$

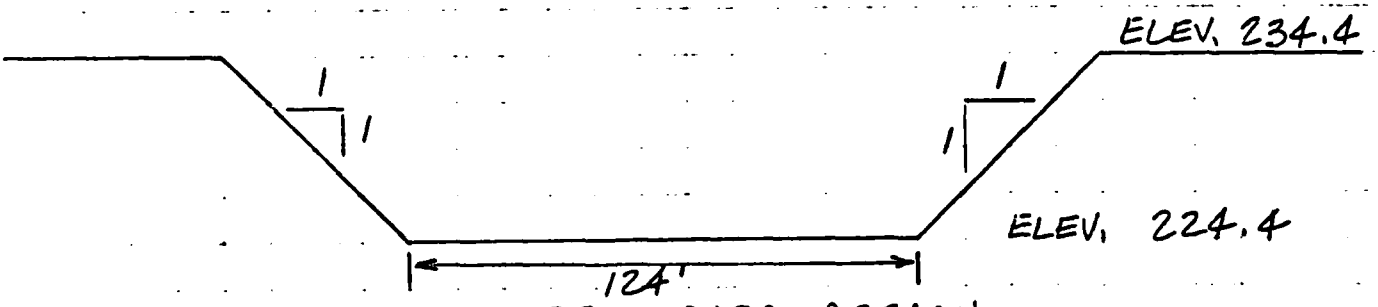
AVERAGE DISCHARGE = 20.25 cfs
AVERAGE INFLOW = 6 cfs based upon 1 cfs/sq. mi.

$$= \frac{39 \text{ acre.ft } (43560) \text{ SQ. FT./ACRE}}{(20.25 - 6) \text{ cfs } (3600) \text{ SEC./HR.}} = 33 \text{ HR.}$$

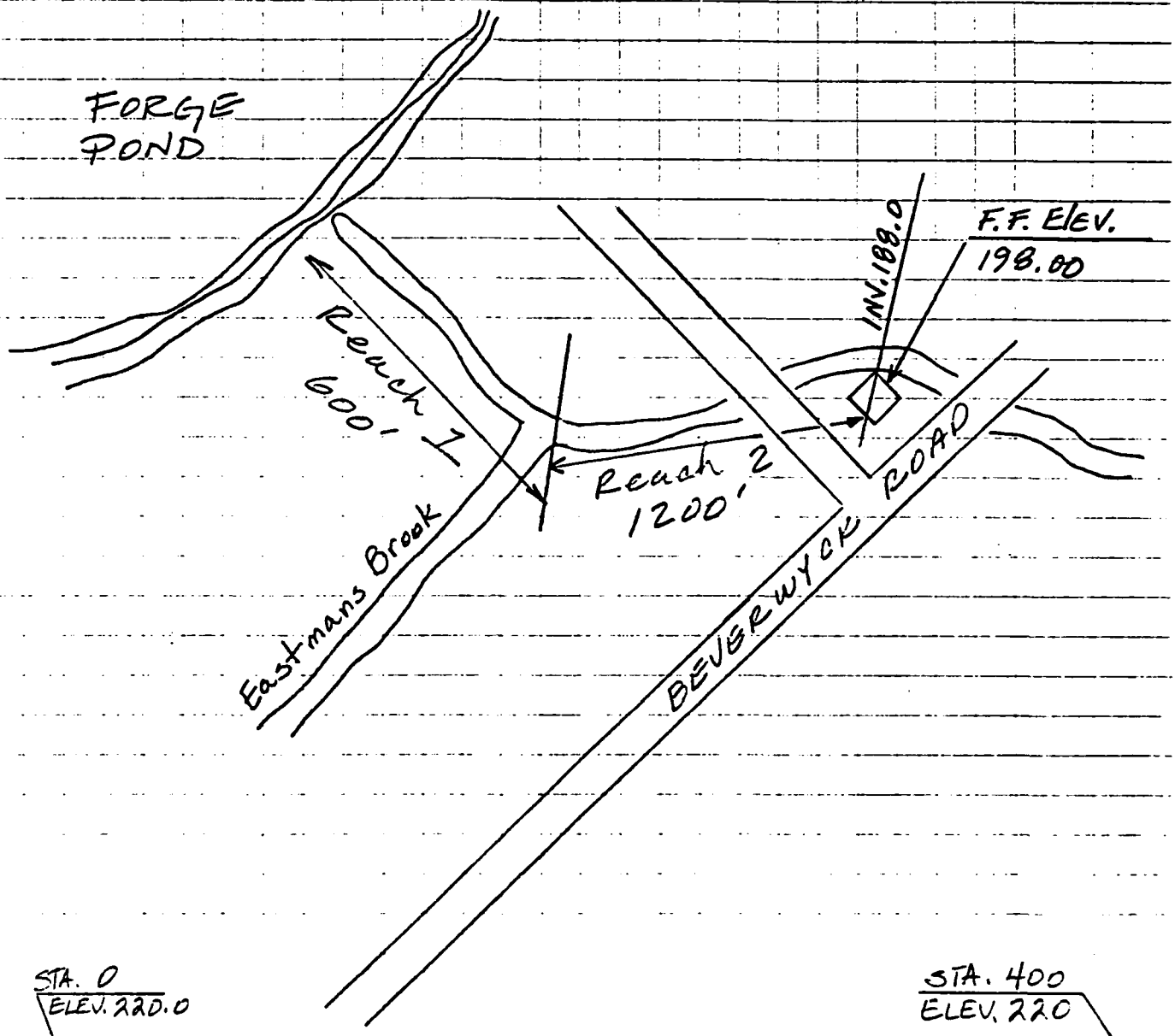
BREACH ANALYSIS

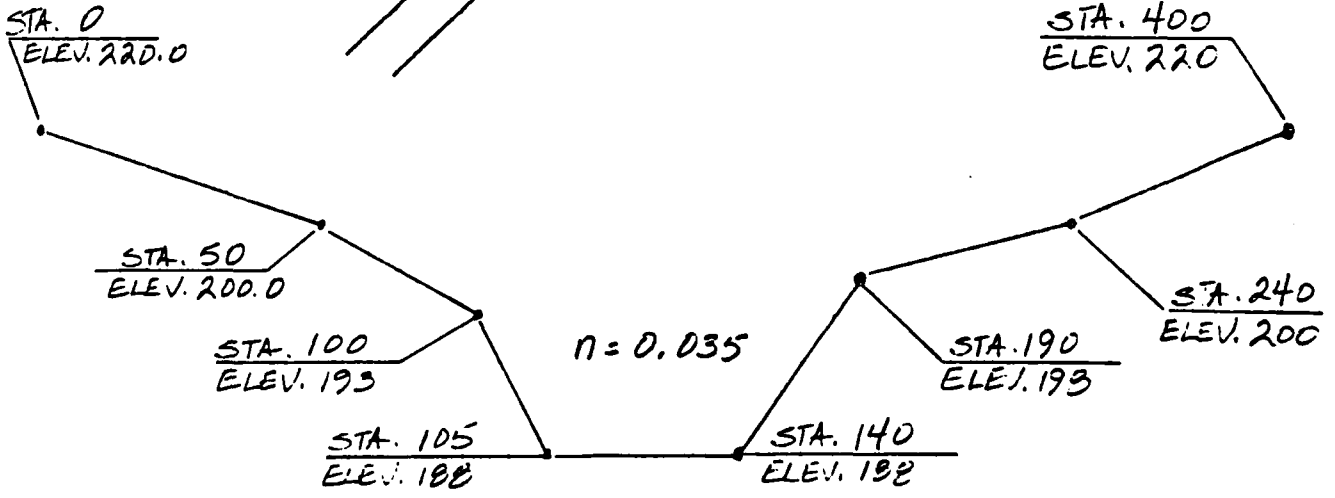
A BREACH HYDROGRAPH WILL BE COMPUTED BY THE HEC-1-DAM PROGRAM AND ROUTED THROUGH TWO DOWNSTREAM REACHES BY THE MODIFIED PULS METHOD. THE ASSUMED BREACH CONDITIONS ARE AS FOLLOWS:

1. THE BREACH BEGINS WHEN THE WATER SURFACE ELEVATION REACHES 234.4.
2. TIME TO DEVELOP BREACH = 0.75 HR.
3. SECTION



FULLY DEVELOPED BREACH



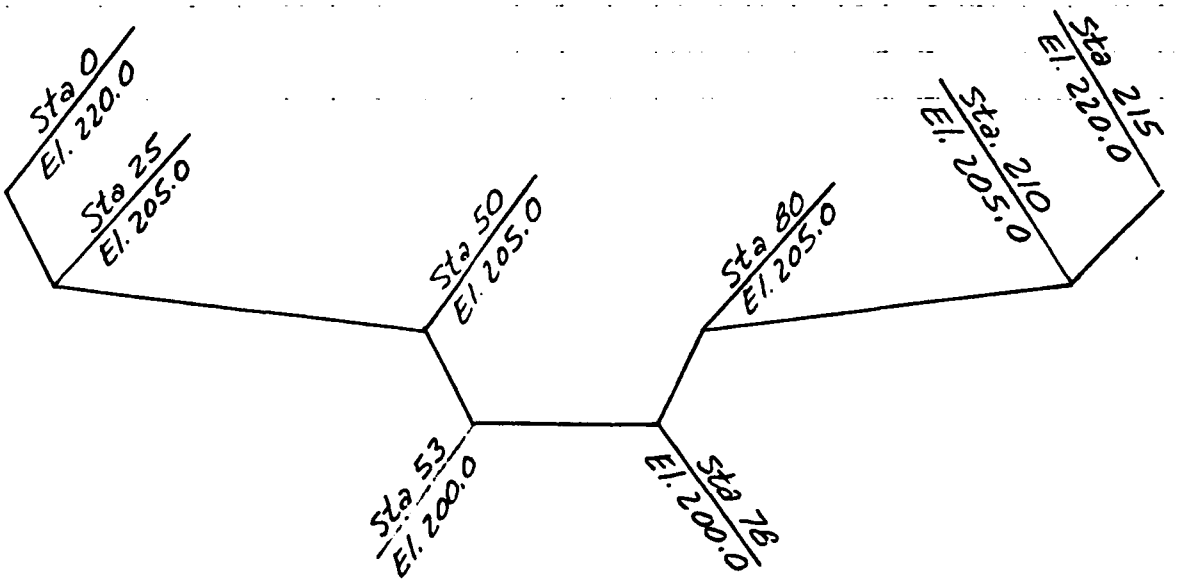


CROSS SECTION END OF REACH 2

S = 0.01

BREACH RESULTS:

1. Peak Outflow = 4050 c.f.s.
2. Maximum channel stage, Reach 2 = 194.2.
3. Dwelling not inundated.



END OF REACH 1 - CROSS SECTION

HEC - 1 - DAM PRINTOUT

Overtopping Analysis

```
1A1       NATIONAL DAM SAFETY PROGRAM
 A2       FORGE POND DAM NEW JERSEY
 A3       100 YEAR STORM ROUTING
 B     300        0       30                                          0       0       3
 B1      5
 J       1        1        1
 J1      1
 K       0     LAKE                              0       0       1
 K1        INFLOW HYDROGRAPH TO FORGE POND DAM
 M       0        2     6.56              6.56       0                               1
 O      48
 O1  0.038    0.038    0.038    0.038    0.038    0.038    0.038    0.038    0.038    0.038
 O1  0.038    0.038    0.038    0.038    0.038    0.038    0.038    0.038    0.038    0.038
 O1  0.038    0.038    0.038    0.038    0.075    0.075    0.075    0.075    0.075    0.075
 O1  0.165    0.165    0.325    0.325    1.500    1.500    0.325    0.325    0.165    0.165
 O1  0.165    0.165    0.075    0.075    0.075    0.075    0.075    0.075
 T                                                          1.5     0.15
 W2             3.0
 X    -1.0    -0.05      2.0
 K       1      DAM
 K1        ROUTE DISCHARGE THROUGH DAM
 Y                                    1        1
 Y1      1                                                -232.0      -1
 Y4  231.2    232.0    233.0    234.4    235.0    236.0    237.0    238.0    239.0    240.0
 Y5      0       10      167      653      915     1397     1943     2545     3199     3902
 $A      0     9.18    34.89
 $E  224.4      230      240
 $$  232.0
 $D  234.4     2.63      1.5    258.7
 K       1        1                                          1
 K1        CHANNEL ROUTING REACH  1
 Y                                    1        1
 Y1      1
 Y6    0.1    0.035      0.1      200      220      600     0.04
 Y7      0      220       25      205       50      205       53      200       78      200
 Y7     80      205      110      205      215      220
 K       1        2                                          1
 K1        CHANNEL ROUTING REACH  2
 Y                                    1        1
 Y1      1
 Y6    0.1    0.035      0.1      188      220     1200     0.01
 Y7      0      220       50      200      100      193      105      188      140      188
 Y7    190      198      240      200      400      220
 K      99
 A
 A
```

NATIONAL DAM SAFETY PROGRAM
FORGE POND DAM NEW JERSEY
100 YEAR STORM ROUTING

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
300	0	30	0	0	0	0	0	3	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 1 LRTIO= 1

RTIOS= 1.00

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH TO FORGE POND DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
LAKE	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
0	2	6.56	0.00	6.56	0.00	0.000	0	1	0

PRECIP DATA

NP	STORM	DAJ	DAK
48	0.00	0.00	0.00

PRECIP PATTERN

.04	.04	.04	.04	.04	.04	.04	.04	.04	.04
.04	.04	.04	.04	.04	.04	.04	.04	.04	.04
.04	.04	.04	.04	.08	.08	.08	.08	.08	.08
.17	.17	.33	.33	1.50	1.50	.33	.33	.17	.17
.17	.17	.08	.08	.08	.08	.08	.08		

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.50	.15	0.00	0.00

UNIT HYDROGRAPH DATA
TC= 0.00 LAG= 3.00

RECESSION DATA
STRTQ= -1.00 QRCSN= -.05 RTIOR= 2.00

UNIT HYDROGRAPH 32 END OF PERIOD ORDINATES, TC= 0.00 HOURS, LAG= 3.00 VOL= 1.00

66.	194.	398.	667.	874.	967.	967.	886.	772.	618.
456.	353.	273.	218.	170.	131.	102.	80.	62.	48.
37.	29.	23.	18.	14.	11.	9.	7.	5.	4.
2.	1.								

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3678.	2547.	791.	268.	38562.
CMS	104.	72.	22.	8.	1092.
INCHES		3.61	4.49	4.56	4.56
MM		91.74	114.02	115.73	115.75
AC-FT		1263.	1570.	1593.	1593.
THOUS CU M		1558.	1936.	1965.	1966.

HYDROGRAPH AT STA LAKE FOR PLAN 1, RTIO 1

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3678.	2547.	791.	268.	38562.
CMS	104.	72.	22.	8.	1092.
INCHES		3.61	4.49	4.56	4.56
MM		91.74	114.02	115.73	115.75
AC-FT		1263.	1570.	1593.	1593.
THOUS CU M		1558.	1936.	1965.	1966.

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTE DISCHARGE THROUGH DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
DAM	1	0	0	0	0	0	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-232.	-1

STAGE	231.20	232.00	233.00	234.40	235.00	236.00	237.00	238.00	239.00	240.00
FLOW	0.00	10.00	167.00	653.00	915.00	1397.00	1943.00	2545.00	3199.00	3902.00
SURFACE AREA=	0.	9.	35.							
CAPACITY=	0.	17.	224.							
ELEVATION=	224.	230.	240.							

CREL	SPWID	COOW	EXPW	ELEVL	COOL	CAREA	EXPL
232.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COOD	EXPD	DAMWID
234.4	2.6	1.5	259.

********** ********** ********** ********** **********

1

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIO 1 1.00
HYDROGRAPH AT	LAKE	6.56 (16.99)	1	3678. (104.16)(
ROUTED TO	DAM	6.56 (16.99)	1	3650. (103.35)(
ROUTED TO	1	6.56 (16.99)	1	3645. (103.22)(
ROUTED TO	2	6.56 (16.99)	1	3644. (103.19)(

HEC - 1 - DAM PRINTOUT

Breach Analysis

SUMMARY OF DAM SAFETY ANALYSIS

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	232.00	232.00	234.40
STORAGE	39.	39.	77.
OUTFLOW	10.	10.	653.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	236.45	2.05	120.	3650.	7.50	21.00	0.00

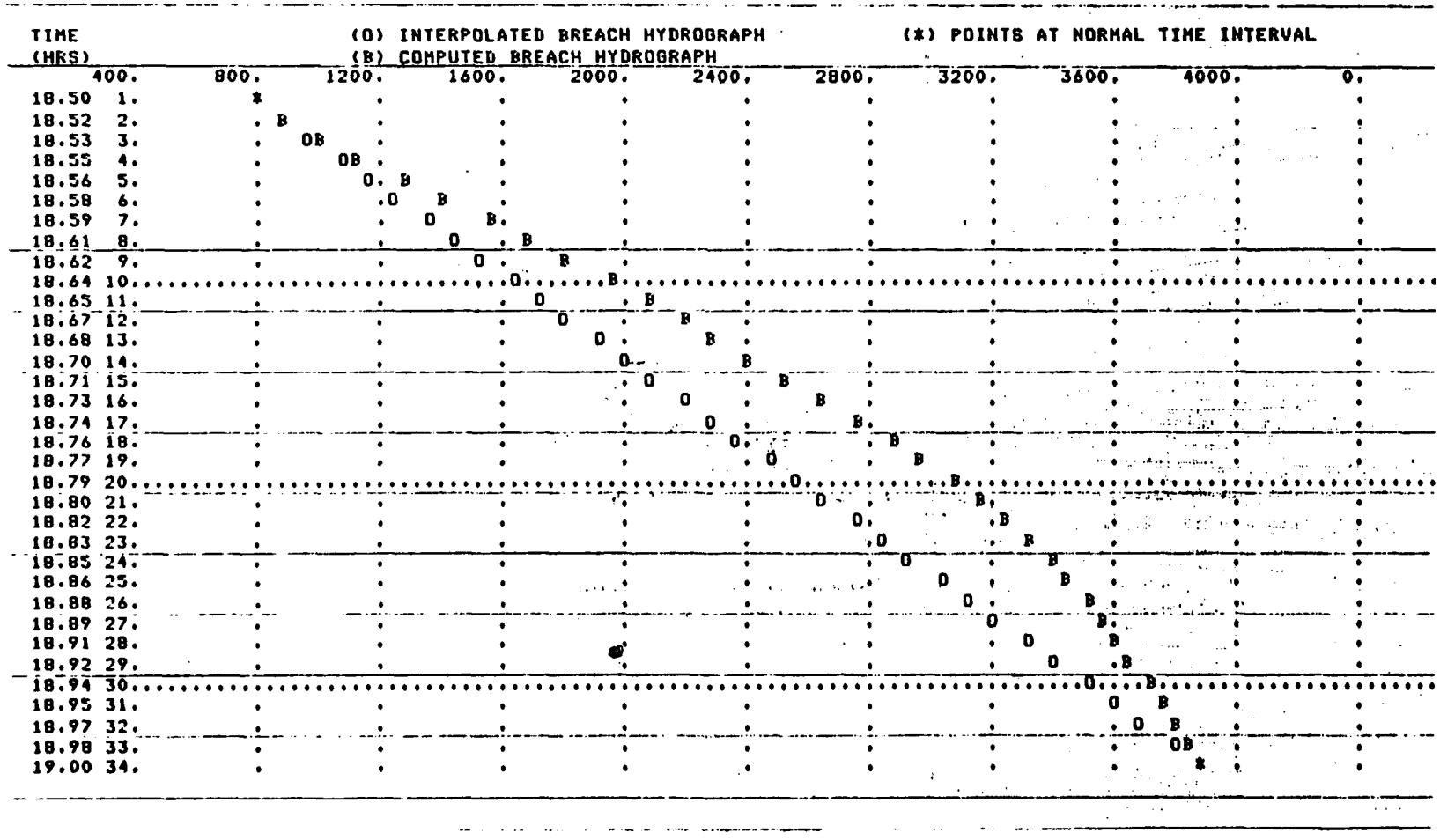
PLAN 1 STATION 1

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
1.00	3645.	205.6	21.00

PLAN 1 STATION 2

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
1.00	3644.	194.0	20.50

```
1A1       NATIONAL DAM SAFETY PROGRAM
A2        FORGE POND DAM NEW JERSEY
A3        100 YEAR STORM ROUTING
B    300        0       30                                          0        0        3
B1     5
J      1        1        1
J1     1
K      0    LAKE                          0        0        1
K1        INFLOW HYDROGRAPH TO FORGE POND DAM
M      0        2     6.56              6.56        0                          1
O     48
O1 0.038    0.038    0.038    0.038    0.038    0.038    0.038    0.038    0.038    0.038
O1 0.038    0.038    0.038    0.038    0.038    0.038    0.038    0.038    0.038    0.038
O1 0.038    0.038    0.038    0.038    0.075    0.075    0.075    0.075    0.075    0.075
O1 0.165    0.165    0.325    0.325    1.500    1.500    0.325    0.325    0.165    0.165
O1 0.165    0.165    0.075    0.075    0.075    0.075    0.075    0.075
T                                                          1.5     0.15
W2             3.0
X   -1.0     -0.05      2.0
K      1      DAM
K1        ROUTE DISCHARGE THROUGH DAM
Y                                    1        1
Y1     1                                                -232.0       -1
Y4 231.2    232.0    233.0    234.4    235.0    236.0    237.0    238.0    239.0    240.0
Y5     0       10      167      653      915     1397     1943     2545     3199     3902
$A     0     9.18    34.89
$E 224.4      230      240
$$-232.0
$D 234.4     2.63      1.5    258.7
$B   124        1    224.4     0.75    232.0    234.4
K      1        1                                          1
K1        CHANNEL ROUTING REACH  1
Y                                    1        1
Y1     1
Y6   0.1    0.035      0.1      200      220      600     0.04
Y7     0      220       25      205       50      205       53      200       78      200
Y7    80      205      110      205      215      220
K      1        2                                          1
K1        CHANNEL ROUTING REACH  2
Y                                    1        1
Y1     1
Y6   0.1    0.035      0.1      188      220     1200     0.01
Y7     0      220       50      200      100      193      105      188      140      188
Y7   190      198      240      200      400      220
K     99
A
A
```


TIME
(HRS)
(O) INTERPOLATED BREACH HYDROGRAPH
(B) COMPUTED BREACH HYDROGRAPH
(*) POINTS AT NORMAL TIME INTERVAL
400.
800.
1200.
1600.
2000.
2400.
2800.
3200.
3600.
4000.
0.
18.50 1.
18.52 2.
18.53 3.
18.55 4.
18.56 5.
18.58 6.
18.59 7.
18.61 8.
18.62 9.
18.64 10.
18.65 11.
18.67 12.
18.68 13.
18.70 14.
18.71 15.
18.73 16.
18.74 17.
18.76 18.
18.77 19.
18.79 20.
18.80 21.
18.82 22.
18.83 23.
18.85 24.
18.86 25.
18.88 26.
18.89 27.
18.91 28.
18.92 29.
18.94 30.
18.95 31.
18.97 32.
18.98 33.
19.00 34.

SUMMARY OF DAM SAFETY ANALYSIS

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	232.00	232.00	234.40
STORAGE	39.	39.	77.
OUTFLOW	10.	10.	653.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	234.66	.26	82.	4050.	.71	19.12	18.50

PLAN 1 STATION 1

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
1.00	3788.	205.7	19.00

PLAN 1 STATION 2

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
1.00	3945.	194.2	20.50

APPENDIX 5

Bibliography

1. "Recommended Guidelines for Safety Inspection of Dams," Department of the Army, Office of the Chief of Engineers, Washington, D.C. 20314.

2. Design of Small Dams, Second Edition, United States Department of the Interior, Bureau of Reclamation, United State Government Printing Office, Washington, D.C., 1973.

3. Holman, William W. and Jumikis, Alfreds R., Engineering Soil Survey of New Jersey, Report No. 9, Morris County, Rutgers University, New Brunswick, N.J., 1953.

4. "Geologic Map of New Jersey," prepared by J. Volney Lewis and Henry B. Kummel, dated 1910-1912, revised by H.B. Kummel, 1931 and M. Johnson, 1950.

5. Chow, Ven Te., Ed., Handbook of Applied Hydrology, McGraw-Hill Book Company, 1964.

6. Herr, Lester A., Hydraulic Charts for the Selection of Highway Culverts, U.S. Department of Transportation, Federal Highway Administration, 1965.

7. Safety of Small Dams, Proceedings of the Engineering Foundation Conference, American Society of Civil Engineers, 1974.

8. King, Horace Williams and Brater, Ernest F., Handbook of Hydraulics, Fifth Edition, McGraw-Hill Book Company, 1963.

9. Urban Hydrology for Small Watersheds, Technical Release No. 55, Engineering Division, Soil Conservation Service, U.S. Department of Agriculture, January 1975.


DATE:
ILME